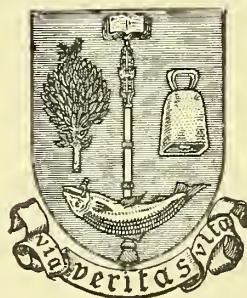





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*For the Library of the University of Glasgow.  
From the President and Council of the Royal College of Surgeons in London.*

DESCRIPTIVE AND ILLUSTRATED CATALOGUE

OF

THE PHYSIOLOGICAL SERIES

OF

COMPARATIVE ANATOMY

CONTAINED IN

THE MUSEUM

OF

THE ROYAL COLLEGE OF SURGEONS  
IN LONDON.

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VOL. V.

PRODUCTS OF GENERATION.

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*Multum fecerunt, qui ante nos fuerunt, sed non peregerunt : multum adhuc restat operis, multumque restabit ; nec ulla nato post mille sæcula præcludetur occasio aliquid adjiciendi.*—SENECA, Epist. 64.

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## P R E F A C E.

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**T**HE Council of the Royal College of Surgeons now present to the public the fifth and last volume of the descriptive and illustrated Catalogue of the Physiological series of Comparative Anatomy contained in the Museum ; thus completing an important design, which Mr. Hunter was prevented from accomplishing by his sudden death.

The primary objects of the catalogue have been, to give a clear and succinct description of each preparation ; to determine the species of animal or plant to which it belongs ; to place it rightly in the proper series, and thus to afford to the visitor of the Museum every facility for studying and understanding this important department of the collection.

Before the formation of the present catalogue, the printed works, from which information could be derived respecting the physiological collection, consisted



of the published writings of Mr. Hunter, the subjoined Synopsis of the Hunterian collection\*, and the Lectures on comparative anatomy by Sir Everard Home. The latter profess to explain the Hunterian collection; but they contain descriptions of a small number only of the preparations, and these descriptions are unaccompanied by any reference to the particular specimens.

The 'Synopsis' is here reprinted, because it exhibits the arrangement of the physiological series which preceded that adopted in the present catalogue; and,

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\* SYNOPSIS OF THE ARRANGEMENT OF THE PREPARATIONS IN THE GALLERY OF THE MUSEUM OF THE ROYAL COLLEGE OF SURGEONS, 1818.

The COLLECTION consists of two Parts: the first Part, of preparations of those organs which are destined for special purposes of existence in Plants and Animals; the second, of those for propagation of the species.

### PART I.

#### ORGANS IN PLANTS AND ANIMALS, FOR SPECIAL PURPOSES.

This Part is divided into Twelve Series.

##### SERIES I.

###### *Parts employed in Progressive Motion.*

1. Productions from sap and blood, brought into one view.
2. Sap and blood: their different kinds.
3. Muscular fibres, variously arranged.
4. Application of Muscles.
5. Elasticity, in aid of muscular action.
6. Structure and growth of Shell.
7. ————— of Bone.
8. ————— of the horns of the Deer.
9. Process by which bones preserve their form while growing, illustrated by the results of experiments made by feeding animals on madder.
10. Cancelli in Bone.
11. Structure of Tooth.
12. Substances employed to sustain the soft parts, in particular animals which have no bone.

13. Joints between bones; arranged in the order of complexity.
14. Joints in the feet of Animals.
15. Structure of the fins of Fishes.
16. Feet of Animals, which demonstrate a peculiar structure.
17. Elastic substance, as a substitute for muscle.

##### SERIES II.

###### *Organs of Digestion, and Instruments of preparing the Food.*

18. Series of different kinds of Stomach.
19. Stomachs *in situ*.
20. Œsophagus: its structure.
21. Stomachs having only one opening, through which the contents are regurgitated.
22. Stomachs consisting of one cavity and two openings; one by which the food is received, the other by which it is carried off.
23. Stomachs having a crop superadded.
24. ————— having more than one cavity.
25. ————— of ruminating animals.
26. Gastric glands.
27. The coats of the stomach digested, after death, by the gastric juice.
28. Gizzards.
29. Teeth in the stomach.

while it indicates the nature and extent of the changes which have been introduced, enables the scientific reader to understand more readily the reasons that are given for them. The alterations consist, for the most part, of a return to the arrangement originally employed by Mr. Hunter, and have been either suggested by the Hunterian manuscript catalogues, or made with the view of obtaining greater simplicity and consistency, and a more regular subordination in the several groups of preparations. The Hunterian documents, for ex-

- 30. Teeth composed of shell.
- 31. ——— composed of horn.
- 32. ——— composed of bone and enamel.
- 33. ——— composed of bone, enamel, and a softer kind of bone.

#### SERIES III.

##### *Intestinal Canal and Glands connected with it.*

- 34. Intestinal canal: its structure.
- 35. Cæcum: its structure.
- 36. Colon and rectum: their structure.
- 37. Anal glands.
- 38. Liver, *in situ*, in different classes of animals.
- 39. Liver: its structure.
- 40. Gall-bladder and ducts.
- 41. Pancreas.
- 42. Spleen.
- 43. Omentum.

#### SERIES IV.

##### *Absorbent Vessels.*

- 44. Roots of plants.
- 45. Lacteal vessels in animals.
- 46. Lymphatic vessels and glands.

#### SERIES V.

##### *Heart, and Blood-vessels.*

- 47. Heart, *in situ*, in different classes of animals.
- 48. Tubes ramifying from the alimentary canal, which probably perform the offices of absorbent vessels, and also of the heart and arteries.
- 49. Heart, consisting of an artery in which the blood undulates.

- 50. The office of the heart, performed by arteries.
- 51. The office of the heart, performed by arteries which have a communication with the veins by means of auricles.
- 52. Heart consisting of two cavities.
- 53. ——— consisting of four cavities, the ventricles having a communication between them.
- 54. Heart consisting of four cavities, the ventricles having no communication between them.
- 55. Valves at the origin of arteries.
- 56. Arteries.
- 57. Veins.

#### SERIES VI.

##### *Organs for the Aeration of the Blood.*

- 58. Gills, fitted for aerating the blood of animals living under water.
- 59. Gills and lungs, by which the animal is fitted to live both in water and in air.
- 60. Lungs, fitting animals to live in air.
- 61. Tracheæ.

#### SERIES VII.

##### *Organs for the Secretion of Urine.*

- 62. Kidneys, *in situ*, in different classes of animals.
- 63. ———, their form and structure in the order of complexity.
- 64. Capsulæ renales.

#### SERIES VIII.

##### *Brain and Spinal Marrow.*

- 65. A ganglion, from which the nerves go off, the animal not having brain.
- 66. Brains, consisting of cerebrum and cerebellum.

ample, seemed clearly to show that it was not the intention of the founder to place the preparations of 'Elastic substance as a substitute for muscle\*' in a subseries distinct and remote from that which illustrated 'Elasticity in aid of muscular action†.' No adequate advantage was gained by retaining the subseries of 'Gizzards‡' distinct from that of 'Stomachs with a superadded crop§.' The physiological relation of these cavities to each other, and the modifications of a single and definite plan of gastric structure, were obviously better illustrated by retaining in the same series all the gradations of complexity

67. Medulla spinalis: its structure.  
68. Coverings of the brain.  
69. Nerves.  
70. Ganglions of nerves.

#### SERIES IX.

##### *Organs of Sense.*

##### *1st.—Feeling.*

71. Cutis, vascular, in the degree of its sensibility.  
72. ———, variety in structure.  
73. ——— preserved nearly 400 years.  
74. ——— retaining artificial marks.

##### *2nd.—Taste.*

75. Tongues of different animals, arranged according to their secondary uses.  
76. Mouth and fauces.

##### *3rd.—Smell.*

77. Nostrils, of animals not having olfactory nerves.  
78. ——— fitted for smelling in water.  
79. ——— fitted for smelling in air, in the order of complexity.

##### *4th.—Hearing.*

80. Internal Ear, fitted for hearing in water.  
81. ———, fitted for hearing in air; in the order of complexity.  
82. External Ears.

##### *5th.—Vision.*

83. Eyes adapted for seeing in water.  
84. ——— adapted for seeing in air.

85. Eyes adapted for great extent of vision.  
86. Eyelids.  
87. Membrana nictitans.  
88. Lachrymal gland and ducts.

#### SERIES X.

##### *Cellular Membrane, and Animal Oils.*

89. Cellular membrane: its structure.  
90. ——— containing Fat.  
91. Animal Oils.  
92. Adipocere: change of all the varieties of soft parts into Fat.

#### SERIES XI.

##### *Cuticle: its different Forms.*

93. Cuticular coverings of Plants.  
94. ——— of Animals.  
95. Rete-mucosum: its different colours.  
96. Cuticle in form of Hair: its growth.  
97. ——— in form of Bristles: their growth.  
98. ——— in form of Feathers: their growth.  
99. ——— lining internal cavities and excretory ducts.  
100. ——— for the defence of external parts.  
101. ——— in form of Scales.  
102. ——— in form of Nails.  
103. ——— in form of Hoofs.  
104. ——— in form of Beaks.  
105. ——— in form of Spines.  
106. ——— in form of Horns.  
107. ——— in form of Spurs.

\* Subseries 17 of the Synopsis.

† Subseries 5.

‡ Subseries 28.

§ Subseries 23.



in the stomachs of birds, which form the most natural and best defined class in the animal kingdom.

As the progress of science is chiefly characterized by the reduction of supposed anomalies to recognized general principles, the physiologist, who may compare the present with the preceding arrangement of the physiological collection, will not be surprised at the suppression of many of the groups of preparations which formerly swelled the series entitled 'Peculiarities in vegetables and animals\*.'

Osseous substance, for example, is a material of the framework, not of ani-

#### SERIES XII.

##### *Peculiarities in Vegetables and Animals.*

108. Peculiarities in Vegetables.
109. Regeneration of Crustaceous coverings in Animals.
110. ————— of Crustaceous stomachs.
111. ————— of cuticular coverings.
112. ————— of parts of Animals.
113. Peculiarities of Bones.
114. ————— of Periosteum.
115. ————— of Bursæ Mucosæ.
116. Substances of which the Skeleton is formed in animals not having bone.
117. Peculiarities of Intestine.
118. ————— of the Arterial System.
119. ————— of the Urinary Bladder.
120. Fat, deposited in particular parts.
121. Tentacula.
122. Holders by exhausting the air.
123. Probosces.
124. Peculiarities of the Mouth.
125. Whalebone substituted for Teeth.
126. Peculiarities in the colour of the Cuticle.
127. ————— in the Male only.
128. Glands, in Animals, for the use of internal parts.
129. Glands, whose ducts open on the Face.
130. ————— the Belly.
131. ————— the Back.
132. Glands near the anus.
133. ————— between the toes.

134. Particular substances secreted by different Animals.
135. Air-bladders for sailing.
136. ————— for swimming.
137. Feet, for swimming.
138. Fins, for flying.
139. Corals, of different kinds, formed by Polypi, for their habitation.
140. Opercula.
141. Animals, inhabiting shells formed by other animals.
142. Instruments employed for inserting Poisons.
143. Electrical Organs.

#### PART II.

##### ORGANS IN PLANTS AND ANIMALS FOR PROPAGATION OF THE SPECIES.

This Part is divided into Ten Series.

#### SERIES XIII.

##### *Organs in Plants and Animals, which are double ; in the unimpregnated State.*

144. Double Organs of Plants, contained in the same thalamus.
145. Double Organs of Plants, contained in distinct thalami.

\* Series XII.

mals in general, but of one only of the primary groups of the class: the substances, therefore, 'of which the skeleton is composed in animals not having bone\*,' as the shells and their opercula† in Mollusks; the calcareous crusts and horn-like coverings of the Articulate animals; the corals and madreporic secretions of Zoophytes, for the defence and support of their delicate gelatinous organs, cannot be regarded as 'Peculiarities,' but as essential members of the normal system of organs of support, equivalent to the bones of the vertebrate animals. The subseries numbered 116, 139 and 140 in the synopsis,

146. Double organs in Animals which impregnate themselves.  
147. ——— in Animals which have a double coitus.

#### SERIES XIV.

##### *Male Organs in Plants and Animals of distinct Sexes.*

148. Stamina of Male Plants.  
149. Testes and penis in Insects.  
150. Testes in Fishes.  
151. ——— in Frogs and Toads.  
152. Testes and penis in Snakes.  
153. ——— in Lizards.  
154. ——— in Testudines.  
155. Testes in Birds, varying in size in different seasons.  
156. Penis in Birds.  
157. Testes, in the class Mammalia, varying in size according to the season.  
158. Testes: structure.  
159. Penis, in the class Mammalia: structure.  
160. Glands whose ducts open into the urethra.

#### SERIES XV.

##### *Female Organs in Plants and Animals of distinct Sexes, unimpregnated.*

161. Pistilla of Female Plants.  
162. Oviducts of Vermes.  
163. ——— of Insects.  
164. ——— of Fishes.

165. Oviducts of Frogs and Toads.  
166. ——— of Snakes.  
167. ——— of Lizards.  
168. ——— of Testudines.  
169. ——— of Birds.  
170. ——— of Ornithorhynchi.  
171. Ovaria and uterus, in class Mammalia.  
172. Clitoris, in the class Mammalia.  
173. Hymen, in the class Mammalia.

#### SERIES XVI.

##### *Coitus.*

174. Coitus: the organs double.  
175. ——— without insertion.

#### SERIES XVII.

##### *Production of Young, in Plants and Animals, with double organs.*

176. Young, produced in Plants without evident seeds.  
177. ——— produced in Animals without evident ova.  
178. Seeds, in plants of the class Cryptogamia.  
179. ——— in plants which have stamina and pistilla in one thalamus.  
180. ——— in plants which have stamina and pistilla in separate thalami.  
181. Ova, in animals which impregnate themselves.  
182. ——— which have a double coitus.

\* Subseries 116.

† Subseries 140.



have, therefore, been removed from the series of peculiarities, and made to precede the parts of the skeletons of the Vertebrata in the first subdivision of the present arrangement.

Changes in the second division of the physiological collection have been made in conformity with the same principles that have regulated the alterations from the arrangement of the synopsis, already noticed; and chiefly consist in the reduction of the formerly extensive series of 'Fœtal peculiarities.' For as every condition that characterizes the progress of the germ to its extri-

#### SERIES XVIII.

##### *Production of Young, in Animals of distinct Sexes, from Ova.*

183. Ova, of Animals which deposit them, previously enclosed in a membranous nidus, in water.
184. ————— which deposit them, previously furnished with the means of being retained in clusters, in water.
185. ————— which pass metamorphoses before they attain perfection.
186. Metamorphoses of the Phalæna, in a regular series.
187. Caterpillar state of different Insects.
188. Various kinds of Nidus, in which the changes to the Insect take place.
189. Ova of Animals, carried in the arms of the mother until hatched.
190. — of Animals, carried under the tail.
191. — of Fishes, shed in the form of spawn.
192. — of Fishes, laid singly.
193. — of Fishes, hatched in the oviduct.
194. — of Animals, which have gills when hatched, but afterwards lungs.
195. — of Snakes, hatched out of the body.
196. — of Snakes, hatched in the oviduct.
197. — of Lizards, hatched out of the body.
198. — of Lizards, hatched in the oviduct.
199. — of Testudines.
200. — of Birds, hatched under the mother.
201. Progress of the formation of the ovum in Birds.
202. Incubation of the ovum in Birds.

#### SERIES XIX.

##### *Production of Young, in Animals which have a Uterus.*

203. Ovaria, in the class Mammalia; exhibiting the changes consequent to impregnation.
204. Uteri with horns, under the changes produced by impregnation.
205. — without horns in the pregnant state.
206. — without horns, after parturition.
207. Placenta: its structure.

#### SERIES XX.

##### *Fœtal Peculiarities.*

208. The yolk-bag, and its connexion with the fœtus.
209. Fœtal circulation in Birds.
210. The knob upon the beak of the fœtus of Birds.
211. The yolk received into the stomach.
212. Funis umbilicalis, in the class Mammalia.
213. Foramen ovale, open, in the class Mammalia.
214. Ventricles of the Heart, of the same thickness.
215. Descent of the testes, in the human fœtus.
216. The testes, not descended.
217. Membrana Pupillaris.
218. Thymus Gland.

#### SERIES XXI.

##### *Growth of Young, in Plants and Animals.*

219. Young plants, from cuttings, taking root.
220. ————— from seeds.

cation from the foetal coverings, or which disappears during that progress, or is suppressed after birth, may be termed a 'foetal peculiarity,' numerous preparations had been transferred from the older series illustrative of the phenomena of foetal development in different classes of animals, and had been brought together in the twentieth series of the arrangement of 1818, in contravention of the special purpose of such older series. Certain stages, for example, in the formation of the vitelline sac, exhibiting as many modifications of its relation to the embryo, were shown in one series of preparations\*; other stages were exhibited in another series†; and a later condition, under the title of 'Yolk received into the stomach ‡,' formed a third separate group. All such specimens have been brought together in the present arrangement and placed in a consecutively ascending order, subdivided only according to the class of animals, the evolution of which such preparations successively illustrate. Thus modified, the series corresponding with that entitled in the synopsis, 'Incubation of the ovum in birds,' now exhibits all the successive stages described by Mr. Hunter in his admirable account of the 'Progress and peculiarities of the chick§'.

It seemed a sufficient reason for suppressing the twenty-first series of the 'Synopsis,' that the preparations included therein exhibited stages of development nearly connected with those which preceding series were expressly established to

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221. Young of oviparous Animals.

222. Changes of the Tadpole into the Frog.

223. Young Animals, of the class Mammalia.

#### SERIES XXII.

*Nourishment and protection afforded by the  
Mother to her Young.*

224. Glandular structure in the crop of Birds,

the secretion of which serves the purpose  
of milk.

225. Glands, which secrete milk : and nipples.

226. The young, attached under the tail of the  
mother.

227. The young, carried in cells, on the back.

228. ——— carried in a pouch on the belly.

229. ——— carried upon the back.

230.|| ——— preserved in nests.

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\* Series XVIII., Subseries 193.

† Series XX., Subseries 211.

‡ The Subseries have here been numbered consecutively, for convenience of reference; they are indicated, in the Synopsis, by the number of the first of the preparations which they respectively contained.

§ Series XX., Subseries 208.

§ Introduction to the Fifth Volume, p. viii.

demonstrate. The preparations illustrative of generation by artificial fission \* have thus been re-united to those exhibiting the same effects by spontaneous fission †. The preparations exhibiting the ‘changes of the tadpole into the frog‡’ are now combined with the analogous and connected specimens constituting the group entitled ‘Ova of animals which have gills when hatched, but afterwards lungs§.’ By thus combining the later with the earlier stages of development in the oviparous classes, the consecutive phenomena of such development in one series are brought under the immediate observation of the physiological student, and he is made familiar with the earlier stages of the formation of the vitellicle and allantois before he arrives at that series (the nineteenth in the synopsis) in which further changes of the allantois are exhibited, and its subserviency to the formation of the placenta is demonstrated.

The preceding observations explain the plan of arrangement adopted in the present catalogue of the Hunterian physiological collection. The following remarks refer to the descriptive part of the same catalogue, and particularize the sources of the additional information that may be found in the present, when compared with the previously existing catalogues.

The printed synopsis, already quoted, is limited to an explanation of the subjects of the several series and subseries of specimens. The catalogues descriptive of the individual specimens have hitherto existed only in manuscript.

The original documents explanatory of the physiological department of the collection are the following:—

*First*, A manuscript catalogue, in Mr. Hunter’s hand-writing, without date, but probably written soon after his return from Portugal in the year 1763. It briefly defines the nature of about two hundred specimens. In this catalogue the natural and morbid structures are grouped together in classes according to the organs; there is then a short series of ‘Monsters,’ followed by specimens of natural history, under the heads of ‘Beasts,’ ‘Lizards,’ and ‘Snakes.’ The articles included in the two latter series were collected for the most part in Portugal, Spain, and Belleisle. This was the germ of the future Hunterian

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\* Series XXI., Subseries 219.

† Series XVII., Subseries 176.

‡ Series XXI., Subseries 222.

§ Series XVIII., Subseries 194.



collection, and the foundation of its several departments, the pathological having been afterwards separated from the physiological preparations. It may not be uninteresting to record this first method of classification, in which the specimens are arranged according to the organs. It is as follows:

Class I.—‘Of the Brain, Medulla, and Nerves:’ then follow, ‘Heart and Vessels;’ ‘Larynx and Œsophagus;’ ‘Stomach,’ ‘Intestines,’ ‘Anus,’ ‘Liver,’ ‘Gall-bladder,’ ‘Spleen,’ ‘Kidneys,’ ‘Capsula renalis,’ ‘Parts of Generation,’ ‘Eyelids,’ ‘Eyes,’ ‘Ears,’ ‘Nose,’ ‘Tongues,’ ‘Skin,’ ‘Bones,’ ‘Epiploon,’ ‘Oils,’ ‘Ligaments.’

The series of the ‘Kidney’ includes, even at this early period, specimens of the injected tubuli uriniferi in the Monkey (‘S. 6,’ now No. 1235); in the Horse (‘S. 9 and S. 10,’ now Nos. 1209 and 1210); and in the Ass (‘S. 12,’ now No. 1208). The same series likewise displays the superficial arborescent veins in the kidney of the Lion and Leopard, and the reticulate arrangement of the same veins of the Seal, and it terminates with the conglomerate kidney of the Porpoise. The series of the ‘Nose’ contains the preparation of the fifth pair of nerves in the nose, figured in the “Animal Œconomy, Pl. XVII. and XVIII.,” where it is described as having been made in the year 1754\*. The original number of this specimen in the old catalogue is ‘c. 4,’ it is now No. 1550: it has thus been preserved eighty-seven years, and may be considered one of the oldest, if not the oldest Hunterian preparation in the collection. The latest date which can be attached to any preparation in the present manuscript catalogue, is 1764; the preparation is the duodenum of a woman who died of a dysentery, and whose case is described in “Dissection 78, of Morbid Bodies, winter of 1764.”

The *second* descriptive document, called the small catalogue, is a small octavo manuscript without date, in the handwriting of Mr. William Bell, and of others who assisted Mr. Hunter. The number of the physiological preparations noticed or described in this catalogue is 561.

The most valuable of the original Hunterian documents relating to the present department of the Collection is the *third*, or quarto catalogue. It consists

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\* Animal Œconomy, 1792, p. 261.

of twenty thin fasciculi, in 4to, in the handwriting of Mr. William Bell and others, with additions and corrections written by Mr. Hunter himself.

The following are the Titles of the ‘Fasciculi,’ and their order of succession. Some of the titles are in Mr. Hunter’s handwriting :—

- “ No. 1. Simple animal matter and moving parts.
- “ No. 2. Growth of bone, horn\*, &c.
- “ No. 3. Composition of the skeleton, application of muscles, &c.
- “ No. 4. Stomachs.
- “ No. 5. Intestines.
- “ No. 6. Absorbents.
- “ No. 7. Hearts, blood-vessels, &c.
- “ No. 8. Respiratory organs.
- “ No. 9. Kidneys.
- “ No. 10. Brain and nerves.
- “ No. 11. The senses.
- “ No. 12. Cellular membrane, fat.
- “ No. 13. Coverings of birds.
- “ No. 14. Cuticle, hair, horn, hoofs, &c.
- “ No. 15. Horn, cuticle, &c.
- “ No. 16. Growth of teeth, feathers, hair, horn, &c.
- “ No. 17. Growth and structure of teeth.
- “ No. 18. Teeth (dry preparations).
- “ No. 19. Peculiarities and regeneration.
- “ No. 20. Reproduction of animals.”

Most of the fasciculi commence with general observations on the series of organs to which they respectively relate ; and these valuable expositions have been introduced, with a few verbal corrections merely, in their appropriate places in the present catalogue. The arrangement of the physiological collection, as it is thus shown to have existed at the decease of its founder, has been strictly adhered to, except in one particular, viz. the position of the series of the teeth. In the time of Mr. Hunter, when the teeth were usually enumerated by anatomists

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\* Antler, or the bony horn of deer, is here meant.



among the bones of the skeleton, probably no other physiologist would have thought of classifying them with hairs and horns. Some of their striking relations to the extravascular productions, thus early appreciated by him, have been subsequently insisted upon by other philosophical anatomists\*, to the exclusion of the facts and arguments which are still valid for regarding them as appendages to the osseous system. The series of the teeth was, however, removed from its old position by Sir Everard Home to that which it occupies in the printed 'Synopsis' of 1818, viz. between the 'Stomachs' and 'Intestines,' or the 4th and 5th of the Hunterian series: it was subsequently transferred by the Senior Conservator, Mr. Clift, to its present position at the commencement of the digestive system.

The chief value and importance of the original Hunterian quarto catalogue consist in the information which it supplies respecting the scheme of arrangement and the general physiological principles intended to be illustrated by the different series. The descriptions of the individual preparations are comparatively few, and these, for the most part, are confined to a brief definition of the object. Many had merely the name of the animal or part written on the top of the bottle, and the rest were without either name or number. It was from these materials that Dr. Baillie, Sir Everard (then Mr.) Home and Mr. Clift commenced, in the year 1793, the formation of the folio catalogue, which constitutes the *fourth* of the manuscript explanatory documents of the present department of the Hunterian Collection, and which served for the use of visitors until the publication of the present catalogue. In reference to the notation of the specimens in the folio catalogue, Mr. Clift has subjoined the following note, prefixed to the list of the different numbers: "No *running number* existed during Mr. Hunter's lifetime, on account of the additions continually making to the Collection. Immediately after his death, a running number, from 1 to 3745, was painted upon them by the Conservator, in order to construct a catalogue from materials left by Mr. Hunter. This was done between the years 1793 and 1800 by William Clift, under the superintendence of Mr. Home, and afterwards written fair into the folio volume above mentioned, after the Collection

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\* See Heusinger, *System der Histologie*, 4to. 1823, Heft ii. p. 160.

“ had come into the hands of the College. A slight inspection of that volume  
 “ will show that the preparations were not in a sufficient state of arrangement  
 “ for a permanent catalogue ; the whole contents of the Gallery were therefore  
 “ re-arranged, and brought into their present relative situations in the year 1817,  
 “ and the whole re-numbered, as in the first column of this book, under the di-  
 “ rection of Sir Everard Home. But a further more careful revision is still  
 “ necessary before a satisfactory catalogue can be made.—1823. WILLIAM  
 “ CLIFT.”

Before placing on the specimens the new series of numbers of 1817, Mr. Clift copied off all the memoranda which had been written in paint on the tops of the bottles ; to these he has added notes, elucidating the history of many of the preparations ; and the three manuscript Fasciculi, containing the original memoranda attached to the specimens, and these additions, constitute the *fifth* explanatory document, and one that has proved of material use in the determination of many of the unnamed specimens. Of the descriptions to which the new system of numbers was designed to refer, those relating to the first series were completed, so that the rest of the Collection could only be studied by the folio catalogue of 1793—1800, through the medium of the lists of double numbers, written fair in a separate volume by Mr. Clift.

A *sixth* document, of much importance in the identification of the individual specimens, is a manuscript catalogue, by Mr. Hunter, of a series of drawings, chiefly taken from preparations in the Museum, and intended to illustrate their description. About thirty specimens, in some instances of complicated and minute structures, have been determined by this mode of comparison.

The original Hunterian descriptions have been retained, as far as possible, in the present catalogue ; additions have been made to them, when they were found not sufficiently clear ; and new descriptions have been given of all the remaining preparations.

The information most commonly required in addition to the previous descriptions and notices, has been the name of the species of plant or animal from which the preparation had been derived.

Where this information is attempted to be given in the manuscript catalogues the reference is commonly to the genus or to some still wider group of animals, as ‘ a monkey,’ ‘ a whale,’ ‘ a beetle,’ ‘ a snail ;’ or the indication is still more

vague, as 'an insect,' 'a sea-worm,' 'a shell-fish,' &c. In a great proportion of the specimens the description relates only to the organ, or ends with 'animal unknown.' In many cases, where the species is more definitely indicated in the folio catalogue, rectification of the name has been found necessary, as will be seen by whoever may compare the present catalogue with that document. The mistakes which have hitherto been detected, have arisen from placing confidence in the statements as to the species of animal contained in the manuscript documents, before experience of their occasional fallacy had shown the necessity of testing them by a dissection of the animal to which they were referred, or by a comparison of the preparation with such descriptions and figures of the anatomy of the same animal as could be found in print.

It is impossible to reason correctly upon the structure of a detached organ, unless the condition of the rest of the organization, and the habits and mode of life of the species, be known; but to this end the name of the species from which the detached organ was derived is indispensable: without this fact, the contemplation of the most elaborately dissected specimen can yield little satisfactory information, and to determine it became therefore the first and most essential step in the formation of a catalogue of the physiological specimens. This part of their history has in most cases been effected by a comparison of the Hunterian preparations with recent dissections. The series of 'Natural History,' or entire animals preserved in the Museum, the numerous specimens presented by different travellers, and the permission liberally granted by the council of the Zoological Society, of taking to the College of Surgeons for comparison the viscera of the animals dying in their extensive menagerie, have afforded such means of instituting the requisite examinations, that the expectation expressed at the commencement of the present work, "that few of the "preparations will ultimately be found deficient in that part of their history "which is most essential to their utility," has been fully realized.

In some instances the unknown specimens have been determined by sufficiently characteristic descriptions and figures in the published works on comparative anatomy. In many cases sufficient of the animal has been preserved to determine the species from external zoological characters, and of these the smaller Invertebrate animals are the chief examples.

The species of organized beings dissected by Mr. Hunter are systematically



arranged in the 'Zoological Index' to the five volumes comprising the present catalogue. This index will show at a glance the range of Mr. Hunter's researches in comparative anatomy; and the zoological writer will readily find what proportion of the anatomy of the species under his consideration may be studied in the Museum of the College.

The wishes and the convenience of physiological visitors have been considered in the formation of another index, in which the preparations are classed according to the organs; under each head reference is made to the number of the preparation in the collection, and to the page of the catalogue in which it is described.

There is, lastly, an alphabetical index of donors, and of other sources, from which the physiological department of the collection has received additions. These additional preparations are marked by the same numbers as the Hunterian specimens which they respectively follow, and are distinguished by an added letter.

The council have great gratification in acknowledging the unremitting labour which has been for many years bestowed on this great work by Mr. Owen, one of the Conservators, and now Hunterian Professor of comparative anatomy and physiology to the College, to whom its publication has been exclusively confided.

Royal College of Surgeons, London,  
8 July, 1841.





## INTRODUCTION.

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THE Fifth Volume of the Physiological Catalogue concludes the description of the extensive collection of preparations and drawings by which JOHN HUNTER designed to illustrate the “several links in the chain of varieties displayed in the formation of the different organs in different animals, ascending in a regular progression from the least to the most perfect<sup>1</sup>,” and in which he practically reduced the previously disconnected facts of Comparative Anatomy to one harmonious and philosophical system.

The preceding volume contained the descriptions of the Organs by which the germ of plants and animals is formed and fertilized: the present volume relates to the Products of the Generative Organs and to the accessory structures and secretions of the parent which are essential or auxiliary to the development and growth of the offspring prior to its acquisition of independent powers of existence.

The scope and nature of the Subdivision of the Physiological Collection containing the ‘Organs of Generation,’ were elucidated by the Founder himself in the last of those manuscripts in the original Hunterian Catalogue designed to afford such general explanations. The want of a similar exposition of the more extensive Subdivision of the ‘Products of Generation’ is attempted to be supplied by the present Introduction, which will contain a brief sketch of the aim and extent of each series of preparations, and in regard to that from the class of

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<sup>1</sup> On the Organ of Hearing in Fishes.—Phil. Trans. vol. lxxii., p. 379, 1782.

Birds, will include one of the most important and remarkable of the posthumous papers of Hunter.

In the first series of preparations in the present Subdivision the botanical visitor will be enabled to study most of the modifications of the impregnated ovarium or 'fruit' of plants which have been selected by modern carpologists as types of their classes or groups of these highly important parts of the vegetable structure.

In the subjoined Classification of Fruits<sup>1</sup>, for example, perhaps one

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<sup>1</sup> "Class I. Fruit simple. APOCARPI.			No. of Prepa- ration.
One- or two-seeded.			
Membranous . . . . .	<i>Utriculus</i>	.	2871
Dry and bony . . . . .	<i>Achenium</i> .	.	
Fleshy externally, bony internally . . . . .	<i>Drupa</i>	.	2872
Many-seeded.			
Dehiscent.			
One-valved . . . . .	<i>Folliculus</i>	.	2873
Two-valved . . . . .	<i>Legumen</i>	.	2875
Indehiscent . . . . .	<i>Lomentum</i> .	.	
Class II. Fruit aggregate. AGGREGATI.			
Ovaria elevated above the calyx.			
Pericarpia distinct . . . . .	<i>Etærio</i> .	.	
Pericarpia cohering into a solid mass . . . . .	<i>Syncarpium</i> .	.	
Ovaria inclosed within the fleshy tube of the calyx . . . . .	<i>Cynarrhodum</i>	.	2878
Class III. Fruit compound. SYNCARPI.			
Sect. 1. Superior.			
A. Pericarpium dry externally.			
Indehiscent.			
One-celled . . . . .	<i>Caryopsis</i>	.	2879
Many-celled.			
Dry internally.			
Apteros . . . . .	<i>Carcerulus</i> .	.	
Winged . . . . .	<i>Samara</i> .	.	
Pulpy internally . . . . .	<i>Amphisarca</i> .	.	
Dehiscent.			
By a transverse suture . . . . .	<i>Pyxidium</i> .	.	
By elastic cocci . . . . .	<i>Regma</i> .	.	
By a longitudinal suture . . . . .	<i>Conceptaculum</i> .	.	

of the most complete that has yet been proposed, Hunter's dissections illustrate the characters of all the primary classes, and of fourteen of

		No. of Prepa- ration.
By valves.		
Placentæ opposite the lobes of the stigma.		
Linear . . . . .	<i>Siliqua.</i>	
Roundish . . . . .	<i>Silicula</i> . . . . .	2882
Placentæ alternate with the lobes of the stigma.		
Valves separating from the replum . . . . .	<i>Ceratium.</i>	
Replum none . . . . .	<i>Capsula</i> . . . . .	2883-5
B. Pericarpium fleshy.		
Indehiscent.		
Sarcocarpium separable . . . . .	<i>Hesperidium.</i>	
Sarcocarpium inseparable . . . . .	<i>Nuculanum.</i>	
Dehiscent . . . . .		
	<i>Tryma.</i>	
Sect. 2. Inferior.		
A. Pericarpium dry.		
Indehiscent.		
Cells two or more . . . . .	<i>Cremocarpium.</i>	
Cell one.		
Surrounded by a cupulate involucre . . . . .	<i>Glans</i> . . . . .	2896-7
Destitute of a cupula . . . . .	<i>Cypsela.</i>	
Dehiscent or rupturing . . . . .	<i>Diplopegia</i> . . . . .	2899
B. Pericarpium fleshy.		
Epicarpium hard.		
Seeds parietal . . . . .	<i>Pepo</i> . . . . .	2901
Seeds not parietal . . . . .	<i>Balausta.</i>	
Epicarpium soft.		
Cells obliterated, or unilocular . . . . .	<i>Bacca.</i>	
Cells distinct . . . . .	<i>Pomum</i> . . . . .	2900
Class IV. Collective fruits. ANTHOCARPI.		
Single.		
Perianthum indurated, dry . . . . .	<i>Diclesium.</i>	
Perianthum fleshy . . . . .	<i>Sphalerocarpium.</i>	
Aggregate.		
Hollow . . . . .	<i>Syconus.</i>	
Convex.		
An indurated amentum . . . . .	<i>Strobilus</i> . . . . .	2902
A succulent spike . . . . .	<i>Sorosis</i> " . . . . .	2903

*Lindley's Introduction to Botany, 1835, p. 197.*

the subordinate groups : the numbers of such preparations are placed opposite the technical name of the kind of fruit which they respectively illustrate. In these clear and beautiful dissections the placental attachments of the seeds to their receptacles are carefully shown, and the botanist cannot fail to recognize the skill and tact manifested in the exposition of the relative position which the carpels bear to each other in their united state, upon which the right theory of the structure of the fruit of plants mainly depends, in consequence of the correspondence of the carpels in this relation with the leaves, of which parts they are essentially modifications.

The collocation and disposition of the germs of flowerless or cryptogamous plants are extensively illustrated at the commencement of the Series, and it terminates with dissections of the germ in different stages of development, and with preparations showing the results of the ingenious and philosophical experiments by which Hunter endeavoured to determine the kind and degree of influence that light, warmth, moisture, motion, or their contraries, and universal gravitation exercise on the direction of the root and stem (radicle and plumule) of the growing plant.

With respect to the impregnated ovum and developing germ of the Radiated classes of animals, preparations in spirit, adapted only for examination by unaided vision, or a low magnifying power, can show little more than their outward form, size, and their relative position to the parent. Hunter has consequently left few dissections of the animals of this group ; but among them those which demonstrate the leading differences in the position of the ovaria in the Star-fishes are especially worthy of notice.

In the Molluscous classes Hunter has selected one of the species remarkable for its ovoviviparous generation (Nos. 2942, 2943), and has displayed several of the singular nidi of the oviparous Mollusks. These nidi are formed by a secretion of the parent for the protection of the tender ova, until the shell of the embryo is sufficiently developed.



The progressive stages of formation of the ovum of the Cephalopods, the development of the embryo, and the peculiar place of attachment of the pedicle of the vitelline sac, are illustrated by dissections of these parts in the common Cuttle-fish.

The series of the present extensive Subdivision of Hunter's Physiological Collection which most strikingly illustrates his unwearied perseverance and determination thoroughly to explore the mysteries of generation, is perhaps that which contains his dissections of Insects. Of the four hundred and eighty preparations from this class of Articulate animals, upwards of forty display the development of the ovum and metamorphoses of the Lepidopterous insects; the external and internal peculiarities of their larva, pupa and imago being illustrated principally by dissections of the Silk-moth. The structure of the cocoon or protecting case of the passive pupa in this species, and the organs of the larva for secreting the valuable material of which it is formed, are shown in thirty preparations: some striking modifications of the pupal covering are likewise exhibited in other genera of Lepidoptera.

The analogous structures for the protection of the larvæ and pupæ of the Bee-tribe, due to the industry of individuals having no concern in the generation of the brood for which they labour,—the progress of development of the ovum, larva and pupa in the cells thus prepared,—and other facts in the singular œconomy of the Social Hymenoptera, are illustrated in forty-five preparations. Many of these preparations are explained or fully described in Hunter's elaborate Memoir on the Hive-bee, published in the Philosophical Transactions for the year 1792. A scarcely less interesting series of preparations of the queen, breeding-cells, and brood of the Humble-bee are similarly illustrated in a manuscript account of experiments and observations on the œconomy of that insect, now for the first time published in the present volume of the Catalogue (p. 38). This beautiful memoir af-

fords an excellent example of the mode in which the habits and generative œconomy of insects ought to be studied.

The remaining preparations of Insects illustrate the peculiarities attending their development in the Coleopterous (Nos. 3065—3083), Neuropterous (Nos. 3145—3154), Hemipterous (3155—3161), Orthopterous (3162—3172) and Dipterous orders. Among the Neuroptera may be noticed the different individuals of the Social Termites, and the structure of the enormously disproportionate ovaria of the queen or fertile female in that genus<sup>1</sup>. The specimens selected from the different orders very clearly illustrate the ‘obtect’ and ‘coarctate’ modifications of the pupa in the insects undergoing a complete metamorphosis, and show the development of the wings of the larva in those insects which are subject only to a partial or demi-metamorphosis. Dissections are also given of the impregnated female in such species, for instance, the Flesh-fly (*Musca carnaria*, L.), as are viviparous and hatch the ova in the oviduct.

The selection of specimens from the class Arachnida illustrates the generative œconomy of the Spiders or oviparous division, and exhibits the partly-developed ova and newly-excluded young which are developed in the sacculated oviduct of the ovoviviparous Scorpions.

The progressive formation and course of the ovum in the internal organs of the Crustacea is beautifully displayed in a dissection of the Lobster, and the modifications of the tail or post-abdomen of the females in relation to the protection of the impregnated ovum during embryonic development are exhibited in this and several other species of that aquatic class of Articulate animals.

The numerous preparations of the gravid ovaries, ova and young of Fishes, and especially those relating to the long unknown and much-disputed subject of the propagation of the Eel and Lamprey, receive

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<sup>1</sup> See also Pl. LXVII., figg. 6 & 7.

the same additional interest and value from the manuscript relating to them as is conferred by Hunter's written record of his lucid and philosophical views upon the other series of preparations that are similarly illustrated. The original observations published at p. 60 of the present volume, advocate the oviparity of the Eel and Lamprey from the anatomical conditions and analogies of the female organs; and the accuracy of the views of Hunter has been subsequently confirmed by the more direct observations on the Generation of the Eel made by Davy and those experienced ichthyologists, Couch<sup>1</sup> and Yarrell<sup>2</sup>.

Besides the ordinary phænomena of the generation of the osseous, or, as Hunter terms them, 'roe-fishes,' he illustrates the curious marsupial œconomy of the Lophobranchiate genera, *Syngnathus* (Nos. 3223—3229) and *Hippocampus* (3230—3231), and very fully exemplifies the female organs, ova and embryo, in both the oviparous and ovoviviparous Cartilaginous Fishes. The deciduous external branchial filaments are displayed in the embryos of two of the species of Dogfish common on the English coasts, viz. *Scyllium Canicula* and *Spinax Acanthias*, and of a larger species of Shark. (See Nos. 3250, 3255, and 3260.)

The circumstances attending the development of the embryo in the class of Reptiles are as completely illustrated as in the class of Insects or Fishes. Species are selected from the Batrachian, Ophidian and Saurian orders, illustrative of the oviparous and ovoviviparous modes of generation in each of these groups of the present diversified class. Most of the external and internal changes accompanying the metamorphosis of the Newt and Frog are displayed in elaborate dissections and entire specimens of the larvæ at each gradation of growth: the exceptional condition under which the brood of the Surinam Toad undergo

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<sup>1</sup> Loudon's Magazine of Natural History, vol. v.

<sup>2</sup> Jesse's Gleanings in Natural History, and History of British Fishes, vol. ii. p. 292.



their transition from an aquatic to a terrestrial organization is not omitted : and the branchial organs and natatory tail of the uterine foetus of the Salamander are likewise shown.

The first appearance of the allantois, as a foetal organ of respiration in the animal kingdom, is displayed by dissections of the embryo of the Snake.

The allantoic and vitelline vessels, with other interesting conditions of the vascular system of the foetus of the higher Reptiles, are shown by careful dissections of those of the Tortoise and Crocodile : these preparations (Nos. 3357 to 3374) are particularly deserving of study, as exhibiting on a conspicuous scale some of the interesting transitory conditions of the vascular system of the warm-blooded embryos ; as the double aortæ and the two ductus arteriosi.

The extensive series of preparations illustrative of the formation and development of the egg in the class of Birds, commences with the changes produced in the ovarium and oviduct, and those which the ovum itself undergoes by the addition of accessory to its essential parts while in the ovarium, and during its passage along the oviducts.

The development of the embryo through the whole period of incubation is illustrated by fifty preparations, many of which are figured in the Plates appended to the present volume, and all of them are evidences of those long-continued researches on animal development, of which the general results were recorded by Hunter in the following account, left in manuscript, of

*“ The Progress and Peculiarities of the Chick.*

“ To understand the progress of incubation, it is necessary we should first understand the anatomy or structure of an egg ; and as it is the Bird we are here describing, it is only necessary to understand the structure of the egg of that order of animals.

“ The mass of an egg is composed of two parts, the orange-coloured



part, called the yolk, and the transparent surrounding part, called the 'white' or 'albumen': but this term is only applied to its turning white upon coagulation; but as it has all the characters of a mucus called slime, I shall call it the slime. The yolk is a portion of the ovaria, or formed by it; which is what I shall first consider.

"The ovarium in the Bird is in one of two states: one is the quiet or [unexcited] state; the other is the state for impregnation. In the first the ova are small, like millet-seed, composed of a little bag filled with a yolk in miniature. They are formed in a cluster in the loins of the Bird, upon the vena cava, as if formed upon it or growing out from it, so as to be inseparable. These small bodies are of different colours in different birds, and sometimes different in the same bird: as the constitution is changing towards propagation these little bodies begin to swell, by becoming fuller of the matter of the yolk. Some advance faster than the others, in a kind of regular gradation, forming regular series. As they advance they become attached by a neck, which is small and pretty long in some. Their capsule becomes extremely vascular, more especially the veins, which run from the neck as a centre, and spread in a radiated form on the membrane, and then, as it were, converge on the opposite side. When nearly arrived at full size an oblong part of the capsule becomes very thin, and the yolk can be seen through it. This gives way and it opens, through which the yolk makes its escape. At this very period we must suppose that the mouth of the oviduct is so placed as to catch it, along which it passes.

"The yolk is in the centre of the slime, seen through it, as it were swimming in it. It is round, and is lighter, in the whole, in weight than the slime, so that it always rises towards the upper side of the egg; but it is not in equal weight in itself through the whole, one side being lighter than the other, which side always keeps uppermost, let the egg be ever so often turned; like the needle to the pole, let the

compass be ever so often turned, the point of the needle keeps to the pole. On this side is the cicatricula, in which the chick is formed, therefore it is always nearest the heat of the mother, although the chick is of more condensed materials, and therefore one would suppose it would destroy this quality on this side of the yolk; yet we find it does not, for this side keeps uppermost till the chick almost fills the whole space or shell, and therefore cannot turn, and now it is not necessary it should. It [the yolk] is of the consistence of thick cream, and is coagulable with heat, solutions of alum, alcohol, goulard, &c.

“At each end\* of the yolk towards the long axis of the egg we may observe a white substance going out, about the size of a white thread, which does not come out at once, but as if its attachment was spread on the yolk, or that it was the membrane of the yolk contracting and sending out the cord. It passes towards the end of the egg, and appears to be increasing in size, more loose in texture, as if gradually dissolving and swelling, and towards its termination it looks like a cloud, or white fumes in the air. These two threads are the axes on which the yolk turns and keeps its lightest side always uppermost. As the most distinct part or terminations of these threads do not turn with the yolk, the thread, or that end which is nearest to the yolk, must twist when the egg is turned; and if the egg is turned oftener in one way than what the threads can twist, then the yolk must turn round with the egg; but as it is not likely this can ever happen in any natural process, no such inconvenience can ever occur.

“On one side of the yolk is a lighter spot than any of the other, which is called the ‘cicatricula;’ in this is the chick formed; but before incubation no traces of the embryo can be discovered, there

\* “I call these ‘ends’ because they are towards the long axis of the egg.”

being no difference between this part that is impregnated and one not impregnated<sup>1</sup>.

“ The ‘ slime ’ is a secretion from the oviduct\*, and is collected by the yolk in its passage along this duct, in its way to the shell-forming part, by which means it surrounds this yolk everywhere, but mostly at the two ends, as the egg is of an elliptical form : and here it appears to adhere to the inner membrane more than anywhere else, probably in some measure connected with the two ends above described. It is transparent, having a slight tinge of a yellow in it. Its attraction of cohesion is such, as allows it to have its figure very much altered, and recovering itself somewhat like an elastic body ; therefore not a fluid whose parts can be moved on each other, and always keep the place they are moved into. It coagulates into a white substance, which appears to be lamellated.

“ These two parts [the yolk and white] are inclosed in a pretty large opaque membrane, which is lamellated, for it can be divided and subdivided into a number of layers ; but it would seem to be divided into two, the innermost the thinnest. At the great end this membrane is separated into two laminæ ; the outer, or that next to the shell, continues to line the shell ; but the inner passes across, leaving a space between the two of about three-eighths of an inch in diameter,

\* “ Birds have but one oviduct when grown up, although two are originally formed ; but it is the left only that remains. In my maiden Preparation<sup>2</sup> there was one on the right side, but it was a kind of dwarf one. This duct is thrown into considerable convolutions (therefore much longer than what was only necessary for a duct), having a meso-oviduct. It may be said to consist of five parts, which are in some degree different in structure. The first may be called the mouth or fimbriæ, which is an oblique opening looking [like] a slit.”

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<sup>1</sup> This similarity can only be understood as referring to the absence of visible traces of the embryo.

<sup>2</sup> Probably No. 2731.

[The Editor's notes are distinguished from Hunter's by being placed below the line, and being referred to by numerals.]



and is concave on that side next to the slime ; though not so much as the outer one on the side next the shell. This space is filled with air. Over the whole is the shell, composed of calcareous earth, about half a line in thickness, the outer surface of which has a vast number of indentations on it, as it were, looking porous. It appears to have no regular construction ; it does not look like crystallization, as in the enamel of the teeth. The colour of the shell in the Common Fowl is generally white, but in some it is brown, as in the Chittagong Fowl. This shell gives the whole a firmness which defends its contents. It certainly admits air to pass both it and the membrane.

“ The egg, which is the produce of the female, or of the female parts in the Hermaphrodite, is to be considered in two lights. In one it is to be considered as the uterus, and in the other as the breast. The slime is the uterine part, intended for the support of the chick while in its uterus or egg ; and the yolk supports it for some days after being hatched, in place of milk, although for a much shorter time ; so that the oviparous animal collects the whole necessary nourishment, and throws it out at once ; while the viviparous retains the rudiments of the young, and furnishes it nourishment as it is wanted.

“ We have reason to suppose that the slime comes nearest to the nature of blood of any animal substance we know ; and we know it is alive, therefore not necessary to undergo any change to have this effect produced ; for it is only the absorption of living parts, therefore, is capable of composing the animal without having undergone the act of digestion ; and in this alone it undergoes but little alteration, as it composes the whole parts without much loss ; for an egg, through the whole process of incubation, only loses . . . grains<sup>1</sup>, and as that

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<sup>1</sup> According to Dr. Prout, the loss of weight in the egg of the Common Fowl during incubation, exceeds by about eight times that which the egg sustains by ordinary keeping : this latter loss is at the rate of about nine grains daily for a certain period.—*Phil. Trans.* 1822, p. 377.



would produce a vacuum somewhere in the egg,—more especially as the parts formed are more solid than the parts which composed them,—therefore it is reasonable to suppose they would occupy a smaller space. But it would appear that the cavity at the thick end of the egg, between the two membranes, was intended as a counterpoise for this loss; for as the chick grows, and of course the whole loses in weight, as also in size, this air-bag swells, by a separation of the two membranes, and fills up the space lost. So that this cavity may be said to be in size, in proportion to the loss and condensation of parts which nourished the chick; and this is one of the purposes answered by it.

“ As the whole volume of the chick and contents of the egg diminish both in size and weight, it is necessary there should be a provision for the first that the space might be filled: for this there is a provision by means of the air-cell at the thick end, which, in the unincubated egg, is extremely small, but increases as the contents of the egg decrease; and this increase of the air-cell is effected by a separation of the two laminæ of which the lining or internal membrane is composed.

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“ This production of animals out of themselves excites wonder, admiration and curiosity; and this is commonly the case in effects whose immediate causes are so obscure, more especially when we are ourselves both effects and causes of the same.

“ The first process set on foot in the formation of an animal is so small, without that form which it afterwards gradually takes on, and its situation so obscure, that its operation cannot be traced but by taking it up at stated times, when we find a new part either added or come to view, or a degree of perfection having taken place in the part.

“ The larger the animal is in any one order, the more perfectly the

parts are seen as they rise to view, and, by this, the intermediate steps in them are more within our view.

“ If we were capable of following the progress of increase of the number of the parts of the most perfect animal, as they first formed in succession, from the very first to its state of full perfection, we should probably be able to compare it with some one of the incomplete animals themselves, of every order of animals in the Creation, being at no stage different from some of the inferior orders ; or, in other words, if we were to take a series of animals, from the more imperfect to the perfect, we should probably find an imperfect animal, corresponding with some stage of the most perfect<sup>1</sup>. But all our observations can only begin at a visible stage of formation, prior to which we are left to conjecture, which could only lead us back to still fewer parts ; but when the first and necessary parts were first formed, as a basis to put the whole succeeding ones into action, so as to increase themselves and form new parts, is not known, nor can it.

“ Glasses lead us back far beyond what the naked eye reaches ; but these only show us the order of priority in the formation of parts. However, human wisdom can go no further than into the distinction of parts, with their actions and uses when formed.

“ The mode of the gradual increase of the parts of an animal may be considered in three views ; one, where it may be supposed that the basis of every part of an animal is laid at the very beginning, and that its visible perfection is no more than the parts beginning to grow as they are wanted, but that they were there in embryo<sup>2</sup>. Another,

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<sup>1</sup> The same philosophical idea seems to have governed Hunter in penning the following passage : “ We may also observe that the first rudiments of every animal are extremely soft, and even the rudiments of the more perfect are similar to the full-grown imperfect, and as they advance in growth they become firmer and firmer in texture.”—*Croonian Lecture for the year 1782, Animal Economy*, ed. 1837, p. 268.

<sup>2</sup> The theory of ‘ Evolution.’

where it may be supposed that at first the parts were formed, but were no more in number than just what were wanted for that state of perfection; and as they came to a degree of perfection, new parts were necessary, and they formed, or formed as they were wanted<sup>1</sup>. And the third is, where the parts were there from the beginning, but that they were altered in form, action, &c.<sup>2</sup>. So far as my observations go, I think I can see all the three principles introduced, but probably not in the same animal, nor in the same order of animals.

“ According to the first, I can conceive there are, at the very beginning, parts which continue through life, and such is, probably, the *Materia Vitæ universalis* and the Absorbing System, which may indeed, according to the third principle, be changed. But according to the second, as the embryo is moving towards perfection, new parts are formed; probably first the brain and heart, with their appendages the nerves and vessels, and so on of all the other parts of the body, which we do not find at first. And we know, according to the third [principle], that many parts are changed in form, adapting their use, arising from that formation, to the addition of parts with the changes in the parts, and this pretty universally.

“ Perhaps the flying-insect is the best example of these observations. This insect has three modes of life, and of course three structures of parts. The structure suitable to the first life [ovum] we know little about, but the difference between the second and third we can examine. In the second life [larva] it appears to have no parts but what are of immediate use for the growth of the animal, and some of them very different in form from what they are afterwards, while others remain the same: so that in the insect we have, in the second life, parts that were probably of use in the first; we have, at least in the second, parts that are of use in the third, therefore do not

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<sup>1</sup> The theory of ‘Epigenesis.’

<sup>2</sup> The theory of ‘Metamorphosis.’



change, such as the brain, nerves, and circulation<sup>1</sup>; but in the third life [pupa], we have new parts entirely, and old ones changed. The new parts formed are, the parts of generation<sup>2</sup>, legs, wings, &c. &c.; parts changed are, the whole of the digestive powers, in some degree the organs of respiration, and probably the organs of sensation<sup>3</sup>. Thus in the progress of growth, in the more perfect animals, we have new parts arising, changes taking place in those already formed, and old parts lost.

“ It may be observed, that the more perfect the order of animals is, it comes to a larger size at the first-life than those of an inferior order: thus, a new-born quadruped is nearer to the size of the parents than a bird just hatched, and a bird nearer than a fish, &c. However, there are varieties in this respect in the quadruped, for some have several at a time, which renders them smaller.

“ From this account we should suppose that a quadruped would be the first for investigation, but as Nature gives to every order of animals a mode of reproduction peculiar to itself, we are led to examine this process in those where its operations are most easily and certainly come at. This must certainly be the case with some of the oviparous, although not with all, and according to the above position the Bird must be the best, and still more so in those that have fewest young in number and largest in themselves.

“ Without this aid our knowledge of this subject would have been very imperfect, and it would almost appear that this mode of propagation was intended for investigation.

“ In the investigation of this subject they have commonly had re-

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<sup>1</sup> These parts can only be said not to be essentially changed, but they are remarkably modified in form.

<sup>2</sup> See Nos. 3025—3028.

<sup>3</sup> See Heroldt, Die Entwicklungs-geschichte der Schmetterlinge, anatomisch und physiologisch bearbeitet, 1815.



course to the Common Fowl, as being the most familiar ; but I found the first appearances so obscure, from want of size in the object, that I had recourse to the progress of the chick in the egg of the Goose. I attempted the Swan, but it was impossible to procure such numbers as to give me all the necessary varieties. I endeavoured to procure ostrich's eggs, by having them sent to me in spirits ; but as the getting such was only a matter of chance, and only one or two in thirty years ! nothing could be made out from them. For this purpose, then, I kept a flock of geese for more than fifteen years, and by depriving them of their first brood in my investigations, they commonly bred again the same season.

“ As hours make a difference in the first days, it becomes necessary to examine in the night as well as in the day ; by which reason, the latter brood in the summer is best adapted, having then short nights.

“ *Of the different Methods to be taken to examine the Progress of the Chick in incubated Eggs.*

“ The first thing necessary is the breaking and removing part of the shell of the egg, which is to be begun at the upper part. In the breaking of the shell of the egg, when the chick is young, as 12, 24, or 36 hours, it should not be broke where the chick is, that is, not at the very upper part, but a little way from it, and break it round this most prominent part for the breadth of a shilling : this is with a view to avoid the sharp corner of the shell wounding the membrane and hurting the first rudiments of the chick. Then take off the shell, leaving the lining of the egg on ; then remove gradually the membrane from over the chick. This must be done with great care and attention ; it should be taken off in layers with a pair of forceps. The egg so prepared should be put into warm water as high as the chick, but not allowed to cover it, as water soon kills it. In this way it may be kept alive some hours. It may be necessary to remark, that,

while the heart of the chick acts, the blood keeps red, but as soon as it ceases to act, the blood becomes almost immediately pale, and soon loses its red colour, therefore it is necessary to keep the animal alive as long as possible \*. When it is examined sufficiently in this state, then, to see the body of the animal still better, the membrane should be cut all round beyond the fœtal circle, and the whole taken off under water, and then have a piece of thin black ivory to slip under it, and put the whole into spirits, which will coagulate the completest formed parts, and bring them to view upon the black ground. In this way I have been able to bring parts distinctly to view that before appeared to be involved in a cloud; also we can bring them under a much larger magnifier, and bring out parts that neither their situation nor glasses could expose.

“ When heat is applied to an impregnated egg, the living parts are put into motion, and an expansion of what is called the cicatrix takes place. This very probably begins at the chick as a centre; but it would appear that the whole did not derive its expansion immediately from the chick, for this part would appear to have powers within itself, and the further from the chick these powers are at an early period, the strongest is this expansion of parts; for we find changes taking place in this circle near to the circumference <sup>1</sup>, sooner than near to the chick, which afterwards become distinct vessels, and communicate with the mesenteric artery of the chick. The chick begins to take form to itself in the midst of this expansion, and as it increases, its influence is extended into the surrounding parts.

\* “ Various were my attempts to effect this, but mostly in vain. I conceived that when I had just exposed the little animal by putting it into water, heated to about 204 degrees, just covering the egg, that I might keep it alive by these means, and observe in the same chick the whole progress of growth; but it soon died; therefore I was obliged to have recourse to a succession.”

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<sup>1</sup> The formation of the *halones* and *blood-lakes* in the area vasculosa is here alluded to.

“ In the beginning of the formation of the chick, there is great distinctness of parts, for they gradually take place one after another.

“ *Of the Membranes of the Chick.*

“ The chick at first, or in its . . . . . hour, is totally void of membrane, only having over it the external membrane of the yolk<sup>1</sup>, which, when removed (which is easily done), the animal is perfectly bare<sup>2</sup>.

“ The first formation or expansion of its membranes are in pretty quick succession, and then go on together, some being sooner completed than others. The first expansion of parts would appear to be the formation of membranes, or changes in membranes naturally belonging to the egg.

“ The first membrane that is formed is the *membrana vitelli*<sup>3</sup>, which forms immediately under the proper membrane of the yolk; so it would appear that at this time the yolk had two membranes (but how far originally so I do not know), the external, a fine transparent one, and the other, more spongy, and having the power of becoming vascular.

“ As the parts of the chick begin to form, such as the head and spine, with the *medulla spinalis*, &c., a proper membrane also begins to form, to cover it. This membrane<sup>4</sup> begins first at the head, and

<sup>1</sup> The *membrana vitelli*, or *cuticula vitelli*.

<sup>2</sup> In the embryo of the Common Fowl the amniotic investment begins to be formed at the eighteenth or twentieth hour, but is not completed until the fourth day.

<sup>3</sup> The ‘blastoderm’ or ‘germinal membrane’, and not the ‘*membrana vitelli*’ of modern embryologists.

<sup>4</sup> The ‘serous layer’ of the germinal membrane: it is also called the ‘animal layer’ by some embryologists; but that the serous layer is the covering, and not the framer or framework of the organs of the animal functions of the chick, seems evident from its extending beyond those parts, over the yolk, to form the false amnios; it only forms the cuticle and the amnios of the embryo itself. It is because the membrane is folded over the substance of the *medulla spinalis* and *vertebræ*, as these are formed, that it has been said to form them. It was first described by Pander, in his masterly Thesis entitled “*Dissertatio sistens historiam metamorphoseos, quam ovum incubatum prioribus quinque diebus subit.*” 8vo. 1817.



seems to arise from the membrane round the head; and, as it increases, it gradually covers the upper or exposed surface of the head, like a hood; then gradually extends itself along the body, covering more and more of it towards the tail, having always a determined edge; and when got to the tail, it there closes up the animal entirely, on the upper side, and which has only the membrana vitelli upon it, making a circumscribed cavity, in which the chick lies, and which I call the 'amnios,' as being the immediate covering of the chick, composing a part of the secondines or after-birth.

" This membrana vitelli [germinal membrane] would appear to have formed itself from the intestine; if so, then it was prior to that part being visible; or it might be considered an expansion of, or a process from, the intestine over the yolk, and under its own proper membrane. That part next to the chick appears to divide into several laminæ, or has the power of forming several; for we find, by the time the whole has formed such and such parts, that we can separate it into . . . . laminæ, which are seen in Plate —, figs. —<sup>1</sup>. This membrane is extending itself over the yolk, expanding itself till its edges come beyond the largest diameter, and now, as it expands in length from the chick, it contracts at its edge, and at last incloses the whole yolk, forming on the opposite side something like a cicatrix, to which the last part of the slime adheres.

" From this account of the yolk, and this membrane, it might appear that this membrane was only at first a covering communicating with the belly of the chick, preparatory to, or for the entrance of the yolk into the abdomen just before hatching. But from its structure

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<sup>1</sup> See fig. 7, Plate LXIX., fig. 5, Plate LXX., and the beautiful magnified view of the chick resting upon the yolk, in Plate LXXI., where *b*, the serous layer, is reflected from *d*, the vascular layer and mucous layers of the germinal membrane, or 'membrana vitelli' of Hunter. See also the mucous layer, *f*, fig. 5, Plate LXXV., reflected from *g*, the vascular layer of the germinal membrane or vitelline sac, in a further-developed embryo.



it would appear to have some use while under incubation, for it first becomes extremely vascular, and on its inside it is thrown into rugæ<sup>1</sup>, as if an increase of inner surface was necessary: wherever this membrane advances, the yolk becomes fluid, beginning at first where the membrane forms, extending itself as the membrane of the yolk extends, by which means it is rendered fit for passing through the duct into the intestine, after being hatched; and it is even not coagulable with heat, so that we may know when an egg has been sat upon, when boiled, for the yolk remains a thin and watery fluid.

“As the chick grows, it presses down the middle of the yolk, first making a deep indent in it; and as it increases in length this indent is increased into a groove, which becomes deeper; and by the time the chick is at its full growth, the yolk is almost divided into two portions, between which lies the chick.

“When the chick is so far advanced as to have most of its parts begun to form, such as the extremities, which is about the . . . . hour<sup>2</sup>, then begins to form the *third* membrane, in form of a circumscribed bag, which seems to come out from the belly near the anus, full of water<sup>3</sup>. This, by increasing, spreads upon the chick, or over the above membrane, and covers them, and as it increases, it covers the whole albumen that remains; and, as the slime diminishes, it becomes also a covering for the yolk; so the chick, albumen and yolk, are at last inclosed by means of this bag; but as it is a circumscribed bag in itself, these parts are on the outside of its cavity; but, by its forming a circumscribed bag, in its double capacity it may be said to form two circumscribed cavities; and it is therefore to be understood that the chick is only inclosed between this bag and the membrane of the yolk, and is therefore not *within* its proper cavity, but upon its outside.

<sup>1</sup> ‘Vasa lutea’ of Haller.

<sup>2</sup> In the embryo of the Common Fowl the extremities begin to bud about the 60th hour.

<sup>3</sup> See Plate LXXI., *f*.

“ This cavity, originally arising from the rectum, communicates with it by a small duct, and probably is formed upon it, through which passes the urine ; whence this cavity should be called ‘ allantois,’ although the membrane that forms the cavity has various uses : it absorbs the slime as it covers it, and therefore should be called placenta : it comes in contact with the shell, and acts as lungs\*.

“ The urine in the chick is similar to that of the adult, a white slimy substance ; that which is in the allantois is firmer in texture, appearing like strings of coagulated white of an egg, when thrown loose into hot water. The water which it contained at first appears to be absorbed, for none is found towards the last stages of incubation.

“ Where the allantois covers the chick it adheres to the amnios, making but one thin membrane between them, but it never becomes attached to the membrana lutei or vitelli<sup>1</sup>. As it extends, it would appear to push from the chick the remaining slime towards the opposite side to that of the chick, as it were clearing the yolk of it more and more, so that the slime becomes smaller, and at last lies like an oblong body close and adhering to the cicatrix of the yolk. So far as these membranes are attached to the membranes of the yolk, they would appear to detach themselves from it by the time it is ready to be absorbed into the cavity of the abdomen ; for none of the other membranes are taken in with it, and it has no other attachment to the abdomen in any of this class of animals.

*“ Of the Use of those Membranes as they arise.*

“ The formation of the chick seems to be but little prior to the formation of the membrana vitelli [germinal membrane], if at all

\* “ In animals that have [an urinary] bladder, this duct forms itself into that cavity. In the Crocodile the bladder opens into the gut, but in the Quadruped the urachus opens into or forms a passage for itself, called urethra.”

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<sup>1</sup> Vitellicle, or vitelline portion of the germinal membrane.

prior; for among the first appearances is a spreading of the cicatricula, and the centre would appear to contain a fluid. That the formation of the chick is considerably prior to the formation of the other membranes is evident; therefore it might be asked, how the chick is nourished, and other functions carried on, till those other membranes are formed? supposing that they absorb the slime. But the membrana lutei [germinal membrane] performs this office, at least at this time, and there was a certain space of the membrana vitelli [germinal membrane] that had the powers of forming vessels and red blood, and which became very vascular. This membrane would appear to answer two purposes, one for the purpose of the chick, another as a covering to conduct the whole yolk into the abdomen.

“ That the membrane which I have called allantois, from its containing urine, answers other important purposes, must appear evident from its extent being far beyond what would answer that purpose. I conceive that the side of this bag, which surrounds and is in contact with the albumen, acts as the chorion or placenta, for it must be by this surface that the albumen is absorbed, and the chick supported. The external part of this bag, which comes in contact with the shell, and as it enlarges lines more and more of it, till at last it lines it everywhere, I conceive to be the lungs, for it is the only part that comes in contact with the air; and on opening an egg pretty far gone, I find that the blood in the veins is scarlet, while it is of the modena colour in the arteries of the bag. Besides, it is much more vascular than any of the other membranes, which is just the reverse of what we should imagine, if it did not answer that purpose<sup>1</sup>.

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<sup>1</sup> The vascularity of the external fold of the allantois, the porosity of the shell, and the difference in the colour of the blood passing from the chick to the allantois, to that returning from the allantois to the chick, give the highest probability to the opinion expressed in



*“ Of the Formation of the Parts of the Chick.*

“ As the parts which act in both stages differ very considerably in their structure, the structure of the first not being adapted to the

the text of the respiratory function of the allantois, and of the necessity of access of air to that membrane through the pores of the shell, for the development of the chick.

But as this opinion is susceptible of rigid experimental proof, it has not been accepted by some physiologists, who have either deemed the circumstantial evidence insufficient to establish it, or have confided in experiments proving that development of the chick *in ovo* had proceeded when all access of the external air to the vascular allantois was supposed to have been cut off.

The result of the common experiment of painting or varnishing the exterior of the egg, by which, when effectually done, the development of the chick is prevented, is obviously inconclusive: since this process may kill, not by keeping out the air, but by keeping in that which should be exhaled; or be detrimental by the directly noxious effect of the substance applied. And again, with reference to the permeability of the egg-shell, it might be questioned whether the presence of air was essential to incubation from the oxygen it contains, or from its mechanical pressure.

The experiments by Erman, commenced in 1810, and published in the *Isis* of Oken for 1818, were performed with an apparatus by which the requisite heat could be applied to a fertile egg in a presumed vacuum, or in an atmosphere of artificial gas; but the apparatus being defective in regard to the luting used to cement the bell-glass to the brass-plate employed, Erman's conclusions, that oxygen was not necessary to incubation, are valueless.

His experiments, repeated by Viborg, with the substitution of a more effectual luting, were followed by the opposite result. Oxygen was found to be essential to development, and atmospheric pressure, afforded by the medium of other gases, as hydrogen and carbonic acid, was followed by no appreciable change in the cicatrix subject to the incubating temperature.

It is obviously essential in any experiments on the influence of air in animal development, to establish, in the first place, by adequate chemical tests, the impermeability to air of the insulating medium of the egg, on whose efficiency in hermetically excluding gas, the value of the experiments altogether depends. When such impermeability of the insulating medium is assumed and not proved, the experiment can only lead to an opinion, and not establish a strictly scientific result.

The requisite pains and precautions, which the present advanced condition of chemical science enables the experimenter to put in practice, have been faithfully and effectually taken by Dr. Schwann, who has made the question, “*De Necessitate Aëris Atmospherici ad evolutionem Pulli in Ovo incubito,*” the subject of a most able and valuable inaugural thesis, published at Berlin in 1834.



œconomy of the second, we have an opportunity of investigating those changes which may be said to give us the gradual formation of parts till completed. The heart is the only visible acting part, and the construction of that viscus in the very young is not similar to that of the full-formed. From hence we can have its formation through its various changes.

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The physiological reader is referred to the treatise itself for the minute and careful account of the apparatus, chemical tests, precautions and plan of the experiments, of which the results are here briefly given.

Development of the germ of the Common Fowl proceeds to the following extent, when the egg is subjected to the incubating heat in a vacuum, in hydrogen, or in azote; that is to say, the cicatrix expands to a diameter of one-third of an English inch; halones are formed; it separates itself from the subjacent vitellus; the serous and mucous layers of the germinal membrane are sufficiently developed to be separable from each other; the area pellucida, or germinal area, is established, and displays a pyriform figure; but beyond this stage evolution does not proceed.

Of the laminae dorsales, with the intervening groove, or the first rudiment of the embryo itself, which is the next stage in ordinary incubation, there appeared no vestige in any of the numerous eggs incubated *in vacuo* or in the above-mentioned gases. The changes which did take place corresponded in nature with those that occur in the egg incubated in atmospheric air, and were accomplished in the same time, viz. eighteen hours. When the incubating heat was continued to be applied to an egg in hydrogen or azote, the changes produced were, a slight inspissation of the albumen, an adhesion of the vitellus to the membrana putaminis, and the destruction of the cicatrix.

Eggs subjected to the incubating heat in carbonic acid underwent no change, and, when afterwards set to hatch under the ordinary circumstances, gave evidence of having been killed, for the cicatrix had vanished, and in its place there was a whitish pultaceous mass.

Two eggs, incubated in hydrogen gas for eighteen hours, and afterwards in common air during three days, exhibited, at the close of that period, the usual degree of development; viz. the embryo, with the sinus terminalis, and the vitelline vessels filled with blood. The same effect was observed in eggs that had been twenty-four hours in hydrogen; but after an exposure for thirty hours to hydrogen, no evolution but only putrefaction followed their exposure to the incubating temperature in common air. Hence it appears that the development of the embryo in the Common Fowl may go on without oxygen in the ordinary course to the fifteenth hour, and that the life of the germ is not destroyed till between the twenty-fourth and thirtieth hour, but that the presence of oxygen is essential to further development.

“The first parts that are visibly formed may be said to be the brain and spinal marrow, although we may conceive the heart and vascular system is also formed, suited to such a state, and that it is co-existing, but not seen, because transparent, while the brain, &c. is opaque, and can be rendered much more so; by which means it becomes still more evident; for if the brain, &c. was transparent, the heart would be the first visible object from its motion, and afterwards becoming reddish.

“The animal would appear to begin at the back, as it contains the spinal marrow, in which is to be included the head, as it contains the brain, and it seems to build forwards, and the new parts are formed in succession; so there appears to be originally no outline of the whole, and the parts to form in it; therefore every part is formed on the outside of the animal: thus we see the heart, then the lungs, the intestines, and over the whole the skin of the abdomen, which is not perfected till the animal is ready to hatch, and sometimes not even then.

“As this only relates to the Bird, it may be supposed to belong to it only; but there is reason to believe it is the same in other animals; for in some monsters, in the Quadruped, we have no abdominal parietes, only the bowels covered by a thin skin, which leads us to conjecture it possible that they also are formed without any abdominal parietes. This state of deficiency of the parietes of the abdomen has all its degrees, some much more, others less.

“The chick is formed first on its back, and then turns on its left side; and till this period the heart is not seen, or if it exists it must lie before the medulla, which will, from its transparency, render it obscure; for in this side view, we see, as it were, the profile, and from its lying in a transparent fluid, it can be seen moving in it even before there is any red blood<sup>1</sup>.

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<sup>1</sup> “The red globules appear not to be a natural part of the blood, but, as it were, composed out of it, or composed in it, and not with it; for they seem to be formed later in life

*“ Of the Blood’s Motion in the Chick.*

“The circulation of the blood in the fœtus of the common viviparous animals may be divided into two parts: the first is that which passes immediately through both sides of the heart with the connexion between the arteries of the right and left side of the heart. The second is that which is connected with the membranes for the fœtus’s nourishment.

“In the oviparous animals the motion of the blood may be divided into three; first, as above, for instance, its motion immediately through the heart, and the communication between the arteries of the right and left side; the second, as above, viz. the connexion with the membranes for nourishment; and the third (which is probably peculiar to them) is the circulation into the membranes for the influence of air, which membranes may be called the fœtal lungs.

“The vessels of the chick are different from the Human, more like the puppy or kitten, although different from them in some of their vessels. The motion of the blood in the chick, in and through the heart, is not different from the Quadruped, that is, the communication between the right side and the left is the same, having a foramen ovale, but the communication between the two arteries is a little different, having two ‘canales arteriosi’ instead of one.

*“ Of the peculiar Arteries of the Chick.*

“These arteries are three; the two first, or what may be called a pair, and which answer to the umbilical arteries in the Quadruped,

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than the other two constituents; for we see while the chick is in the egg the heart beating, and it then contains a transparent fluid before any red globules are formed, which fluid we may suppose to be the serum and lymph. Whatever may be their utility in the machine, the red globules certainly are not of such universal use as the coagulating lymph, since they are not to be found in all animals, nor so early in those that have them.”—*On the Blood and Inflammation*, 4to. 1794, pp. 45, 46.



arise from the iliacs, and pass by the sides of the bones of the pelvis towards the opening in the abdomen, and when got out of that cavity through this opening, ramify on the three membranes above described. The third<sup>1</sup> is a continuation of the mesenteric artery, and is principally lost on the membrana lutei.

*“ Of the Veins.*

“There are two venæ umbilicales ; one (which is the largest) belongs to the amnios, chorion and lungs<sup>2</sup>, and is similar in its termination to the umbilical vein in the Quadruped, the trunk of which passes into the abdomen, then upwards to the liver, enters between its lobes, and opens into the vena cava inferior, just as it enters the heart. The other<sup>3</sup> belongs to the membrana lutei, and passes into the abdomen, joins the mesenteric vein, which would appear to divide into two, one forming the vena portarum, the other joins the vena cava inferior between the kidneys, and which communication remains through life.

“In the diastole of the auricles more blood passes into the right than what it can contain, and the overplus passes, as it were, through the right auricle into the left, while at the same time the left is receiving blood from the lungs, so that the left is filled partly from the body, therefore they are equally filled with blood. But the quantity from the lungs is increasing every day in proportion as the lungs increase, for the lungs can hardly be said to be coeval with the heart.

*“ Of the Brain and Spinal Marrow.*

“It would appear upon [examining?] the most early of these parts, that they were originally formed in two distinct parts, a right and a

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<sup>1</sup> Vitelline or omphalo-mesenteric artery.

<sup>2</sup> By ‘chorion and lungs’ Hunter intends the ‘allantois’.

<sup>3</sup> Vitelline or omphalo-mesenteric vein.



left; at least there is a transparent line which runs through their whole length, dividing them to appearance into two; but these parts are too small and too tender to allow of ascertaining this as a certain fact; and indeed this division takes place in some degree in parts in the adult; for we find the cerebrum and cerebellum divided into two, as also the medulla spinalis nearly divided into two, longitudinally. The union in the brain of the chick seems to take place soonest about the basis of the brain, making the anterior end appear as if slit into two, like a pair of pincers.

*“Of the Formation of the Intestines, &c.*

“The intestines, and probably the liver, spleen, kidneys<sup>1</sup>, &c., are the latest formed; yet the principle upon which they are formed must be begun early, for the mouth is early formed, as also we may suppose the anus, for the bag described as above [allantois] arises from it; therefore there is only the intermediate canal to form, and its communication with the yolk; but as all those parts are only fitted for the second stage of life, it was only necessary they should be perfected by that time. The small intestines which join the yolk are drawn further out of the belly as the chick grows, but before the chick hatches they are gradually pulled in<sup>2</sup>.

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<sup>1</sup> The kidneys begin to be formed in the chick on the sixth day, and in the Tadpole as it is passing from the embryo to the larva state. But there are excretory organs prior to the kidneys, called from their discoverer the ‘Corpora Wolffiana,’ consisting of hollow cæca attached to an excretory duct, and developed in birds on the third day, which secrete a yellowish urine; so that the allantois may contain urine from the first period of its existence. The corpora Wolffiana disappear in birds at the time of exclusion, in Batrachia at the latter period of the larva state, and in Mammalia earlier, in Man soonest of all. See *Müller, Bildungsgeschichte der Genitalien, Dusseldorf, 1830.*

<sup>2</sup> The observations of Wolff on the development of the digestive organs of the Chick, published in 1774, are more numerous and precise than those of Hunter. Of the formation of the glands Hunter says nothing. Malpighi seems to have been the first who recognized the primitive form of the liver. ‘*Septimâ terminatâ die*’—‘*Jecur ipsum, subluteo interdum*

“The parietes of the abdomen are the latest in being formed, and when that is effected the animal is completed, but this is much later in some of the oviparous animals than in the Quadruped, and the lateness of forming this part is owing to the yolk’s being taken into the cavity of the belly at or near hatching; and to effect this purpose we find that from the circumference all round the opening into the belly arises a muscular expansion which enters the yolk (besides its proper membrane), surrounding the whole, which by its contraction draws the yolk towards the opening, and then by its contraction that part of the yolk which is close upon the mouth of the opening is shoved into the belly; and by this action some of the yolk (which is become fluid) is squeezed into the intestine, which by regurgitation in that canal is carried up into the stomach, and is there first coagulated to be afterwards digested.

“As birds have air-bags within the abdomen, I find that at a certain period of growth of the chick they begin to form. They begin at the lower point of the lungs like a small hydatid, and extend further and further into the abdomen, before and on the outside of the kidneys: they are at first full of a fluid; as they extend, they are, as it were, squeezed among the intestines, so as to take on the shape of the intestines of those parts, and at last filling the whole abdomen among them. Soon after others are forming, or other openings communicating with this, and the lungs are also beginning to attach themselves so as to form a communication with other parts, as the ribs, sternum, vertebræ, &c.

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suffusum colore, quandoque cinereo, auctius et solidius reddebatur, et ipsius glandulæ non omnino rotundam et sphæricam referebant figuram, sed oblongiores et quasi *cæcales utriculos*, ductui hepatico appensos, representabant.’—*Epist. de Formatione Pulli*, p. 9. *Op. Om.* fol. 1687.

Von Baer and Müller perceived the first development of the liver in the chick at the middle of the third day; it then appeared as two pyramidal hollow cæca developed from the duodenum.

“The lungs are, at first, detached bodies, as in the Quadruped, but when arrived about the third week (in the Goose) they begin to be attached to the ribs, but not so early to the diaphragm.

“Among the latest formed parts of the chick are the eyelids. When gone through one half of their period of incubation, the whole anterior surface of the eye is exposed, and the termination of the common integuments is perfectly round, as in fig. [12. Plate LXXVI.] But in a day or two more it begins to form itself into an oblong opening, as in fig. [16. Plate LXXVI.], which becomes narrower, as in fig. [5. Pl. LXXV.], and then the increase of lid becomes more remarkable in the lower lid, becoming first almost straight, as in fig. [17. Plate LXXVI.], which afterwards becomes rounded on its edge, almost covering the whole of the lower part of the eye, as in fig. 18. Plate LXXVI., and about a day or two before they are hatched the lower lid has spread upwards so much as almost to cover the whole eye, as in fig. [Plate LXXVIII.].

“The membrana nictitans begins earlier to form than the eyelids, for in fig. 16. Plate LXXVI. it is seen at *a*, and its increase may be observed in all the other eyes at letter *a*.

“It may also be observed, that at no period could I observe a membrana pupillaris.

“The little horny knob<sup>1</sup> at the end of the beak with which it breaks the shell when arrived at the full time and makes its escape, is also gradually forming into a more regular and determined point, the progress of which is seen from the first figure to the sixth.

“When very young we may observe *two* oviducts, one on each side; they would appear to be behind the kidneys at their first formation, but become more and more forwards as the chick grows, and before hatching the right seems to decay.

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<sup>1</sup> Plate LXXVI. figg. 17 & 18, *b*.



“There are two kinds of down on the chick, one long, which comes first, about two or three days before hatching ; a second, or fine down, forms at the roots of the other. It is probably the long down that comes off with the feather.

“The chick some time before birth has a kind of mixed action of life, for it breathes, and we can hear it pip and chirp in the egg ; and we find that the adult circulation through and out of the heart is formed before birth : yet it is receiving its nourishment from the remaining slime.”—*Hunterian Manuscript*.

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In the class Mammalia, the Hunterian illustrations of the conditions of the fœtus, its appendages and envelopes, are exclusively derived from species of the Placental orders.

Hunter has left on record an expression of his regret at the want of opportunity to investigate the generation of the Marsupialia, in which he justly avers that function to be the most interesting part of the natural history of animals. Speaking of the Opossum, he says, “There is something in the mode of propagation in this animal, that deviates from all others, and although known in some degree to be extraordinary, yet it has never been attempted, where opportunity offered, to complete the investigation. I have often endeavoured to breed them in England : I have bought a great many, and my friends have assisted me by bringing them or sending them alive, yet never could get them to breed ; and although possessed of a good many facts respecting them, I do not believe my information is sufficient to complete the system of propagation in this class<sup>1</sup>.” Since the time of Mr. Hunter, the introduction of the Kangaroo into our menageries, and its frequent breeding, have afforded opportunities of elucidating many of the peculiarities of the Marsupial generative œconomy ; and

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<sup>1</sup> Zoological Appendix to White's Journal of a Voyage to New South Wales, 4to. 1790.



the transmission of the impregnated uteri of the Kangaroo and Ornithorhynchus to the Museum by enlightened and liberal Donors, has tended still more satisfactorily to supply the deficiency which the Founder had occasion to regret in the present department of his Physiological Collection.

In the higher organized Mammalia, in which the exterior foetal envelope, or chorion, is organized, and its vascular and more or less villous surface is brought into more or less intimate contact and cohesion with the womb, Hunter has left examples of all the leading modifications of the placenta, together with ample illustrations of that complex cellular and vascular structure which he had been the first to demonstrate in the placenta of the Human Subject.

From the Mare, the Ass and the Sow, are selected examples of the uniformly diffused and simple villosity of the chorion, which holds the place of the circumscribed and more compact placenta in the higher Mammalia.

The elongation of the vascular villi, and their aggregation into circumscribed groups, to form placentulæ or cotyledons, are demonstrated in the Ruminantia; those species apparently being selected which exhibit the most characteristic differences in the forms of the cotyledons, and in the structure of their component villi. The different stages in the development of the uterine and foetal cotyledons are also shown, and advantage is taken of their reciprocal relations in the Ruminantia to demonstrate, by injections of different colours, the non-continuity of the foetal with the maternal vessels.

The annular placenta in the Carnivora, its cotyloid form in the Insectivora, its circular disciform figure in the Rodentia and Cheiroptera, and its bilobed structure in the tailed Quadrumana of the Old World, are all exemplified in well-chosen examples.

It must be admitted, however, that in these neatly dissected and often beautifully injected preparations, the relations of the allantois

to the foetus and amnios, and the varying form and condition of the vitellicle or umbilical sac, are seldom clearly displayed.

It is only in the preparations of the Human Embryo, among the Mammalia, that we first perceive any plain demonstration of that primitive and universal vesicle,—the vitellicle—which is the foundation and seat of the first stages in the development of the embryo in every animal generated from an egg; and the only foetal appendage and seat of a subsidiary circulation in most of the classes.

In the extensive series of preparations illustrative of the development of the Human Foetus, the changes which the impregnated uterus undergoes, the structure and relations of the peculiar production of the uterus, the confluence of the two layers of the decidua, and the gradual obliteration of the decidual cavity, are first shown; and then the rapid changes by which, after parturition, the uterus regains its original form and size are exhibited. To these succeeds a very extensive and closely gradational series, illustrating the changes in the chorion of the human embryo up to the complete establishment of the placental structure. The umbilical vesicle is exhibited in Nos. 3620, 3622, 3628, 3634 and 3636: the preparations and injections of the placenta are numerous, and establish as clearly as preparations are adapted to do, the structure which Hunter has ascribed to the Human Placenta. With respect to the development of the Human Foetus, Hunter's preparations are chiefly limited to show the changes in its external form.

The nature and organization of the corpus luteum are demonstrated in a series of thirty-two dissections, from different species of Mammalia; in some of which the progressive changes of the impregnated ovisac after the escape of the ovum are shown, and the whole is peculiarly adapted to afford the desired demonstration of this difficult and much-disputed point in Embryology.

In the series entitled 'Foetal Peculiarities,' the preparations which

illustrate one of Hunter's earliest anatomical essays, viz. that 'On the Situation of the Testis in the Fœtus, with its Descent into the Scrotum,' must excite more than usual interest, as being among the earliest of a class of investigations which afford the most philosophical insight into the essential nature of many of the peculiarities of the adult structure: and the philosophical anatomist will not fail to notice in the contiguous preparations, as that of the Armadillo, the illustration of the principle, that an anatomical condition, as the abdominal position of the testes, which is transitory in the Human Subject, may be persistent in an animal of an inferior species.

After having displayed the progressive development of the germ, the fœtal appendages and envelopes, and the modifications of the impregnated oviduct and uterus in the different classes of animals, Hunter next proceeds to show how the young animal in many cases, after its extrication from the fœtal coverings, is nourished and sheltered by the parent until it has acquired sufficient powers to provide for its own support.

In the first of these series of accessories to the generative function, we find the mammary glands,—structures exclusively confined to the highest class of animals, and suggestive of the name of the class in Modern Zoology. This series, however, commences with those well-known preparations from a species of another class, which illustrate the temporary alteration of the structure of a common part to fulfil the partial function assigned to a special gland in the Mammalia. They form the subject of one of those ingenious and beautiful memoirs<sup>1</sup> in which Hunter's extensive physiological researches enabled him to point out the true analogies and scientific import of a popular fact.

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<sup>1</sup> On a Secretion in the Crop of Breeding-Pigeons for the nourishment of their Young.—*Animal Economy*.



In the Marsupial order the peculiarities of the mammary gland and nipples are shown in connexion with the peculiar abdominal cutaneous pouch, which contains the nipples, and which forms a natural nest for the prematurely-born, minute, and naked young of these singular quadrupeds. In this series Hunter has left several beautiful dissections of some of their most important peculiarities during that period of their development when they are suspended in the pouch, blind, naked, and in an almost passive state from the nipple, like a fœtus by the umbilical cord; and in which state they have not unaptly been termed 'mammary fœtus.' The tubular mouth, and the grooved tongue, by which the young retain a firm hold on the elongated nipple are shown, and afterwards the mechanical relations of the larynx to the posterior nostrils, by which the trachea is defended from the entry of the stream of milk injected down the fauces of the feeble mammary fœtus by the constrictor muscle of the mammary gland. The facts which Hunter illustrates by means of these peculiarly clear and intelligible dissections, were probably among those, to the possession of which he alludes in the passage above quoted from his Zoological Description of the Animals brought from New South Wales.

His general acquaintance with the animal œconomy has enabled him to place in juxtaposition with the series illustrative of the œconomy of the marsupial pouch, the analogous natural cavities on the exterior of the body for sheltering the products of generation in other classes, as, for example, the dorsal cutaneous cells of the Surinam Toad, the ventral marsupium of the Hippocampus and Syngnathus, and the subcaudal, ciliated, ovigerous recesses and plates in the Crustacea.

The series of Nidamental Structures concludes with specimens of the artificial substitutes for natural nests when these form no part of the structure of animals, whose progeny, after their extrication from



the foetal envelopes, require such shelter. The most perfect and complicated fabrications for this purpose are those of the song-birds of the Passerine order, from which Hunter has selected his examples; and the last specimen in the series is the product of a similar instinct in a species of that order of Mammalia, the Rodents, which in many parts of their structure, as well as in this particular of their generative œconomy, present a close analogy to the Feathered Tribes.

In the preparations, one thousand five hundred and seventy in number, which illustrate the functions by which the species of organized beings are continued upon the earth, the physiological student has presented to him, first, the organs that form and fertilize the germ; he is then enabled to trace the evolution of the new product, as embryo and foetus, in connexion with its variously modified appendages and envelopes in the different classes of organized beings; and finally, its progress, subsequent to birth, by means of the protection and food supplied by the parent, to the acquisition of the condition and faculties of an independent being.

The First Division of the Physiological specimens gives the requisite illustrations of the organs and functions by which the individual is capable of self-support: to this subject the series of the Second Division have naturally led; and thus is completed the illustration of the great circle of the functions of life, which is the aim and subject of the Physiological Department of the Hunterian Collection.



# CATALOGUE.

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## GALLERY.

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### DIVISION II.

CONTINUATION OF THE SPECIES IN PLANTS AND ANIMALS.

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### SUBDIVISION II.

PRODUCTS OF GENERATION AND DEVELOPMENT OF THE  
GERM.

#### SERIES I. In Plants.

2858. A portion of a Sallow (*Salix Caprea*, LINN.), separated by artificial fission from the parent stem, planted in moist earth for a short time, and then uprooted: it exemplifies the effects of the inherent capacity for self-existence in the separated part, which has sent downwards several roots, and put forth from the upper and exposed extremity a leaf-bearing shoot.
2859. A strip of the liber or inner bark from some dicotyledonous plant, most probably a Willow, showing the development therefrom of adventitious roots proceeding from the ligneous body.

- 2859 A. A small Fern (*Asplenium rhizophyllum*), the elongated fronds or leaves of which bend down, and, having reached the ground, take root, put forth new fronds, and thus assume the character of reproductive buds.

The normal mode of generation is likewise exemplified in this specimen by the groups of the capsules or 'thecæ' which contain the minute seeds, sporules, or reproductive particles, and which are developed in the back part of the fronds. *Presented by Sir Everard Home, Bart.*

2860. A portion of a frond of a Fern (*Polypodium aureum*), exhibiting circular groups of brown-coloured granules, attached to the back part of the frond: these groups are called 'sori'; the apparent granules are hollow and are termed capsules, or 'thecæ': they contain the reproductive bodies, or sporules. The capsules consist of a fragile cellular membrane, and are encircled by a thickened longitudinal elastic ring composed of a single series of cellules: as the sporules increase in number the walls of the capsule are stretched; and when the strength of the elastic ring or 'gyrus' is at length overcome, it breaks, the capsule is violently torn open, and the sporules are dispersed in every direction.

- 2860 A. The summits of three fronds of a Fern (*Sphaeropteris barbata*), from the Himalayan Mountains, showing the sori arranged in a single longitudinal row on each side of the stem: they are inclosed in a common envelope or indusium of a globular form burst by a transverse fissure at the summit, and are remarkable for their pedicellate mode of attachment. *Presented by Sir Everard Home, Bart.*

2861. A portion of the frond of a Fern (*Asplenium Adiantum Nigrum*), showing the capsules containing the reproductive sporules aggregated in straight longitudinal groups, covered by an oblong or linear indusium and attached to the back or under side of the leaves.

2862. The frond of a Fern (*Lustræa Filix mas*), exhibiting the circular sori covered by a reniform indusium, and attached in double rows to the back part of the lateral divisions, the veins of which are disunited.

2863. The frond of a Fern (*Polypodium vulgare*), showing the sori similarly arranged but of larger size and destitute of an indusium; the component capsules or thecæ are very conspicuous in this specimen.



2864. A portion of the leaf of a Fern (*Scolopendrium vulgare*), in which the sori form transversely elongated linear groups disposed in contiguous pairs on the back part of the leaf; each pair is covered by a double indusium, which has the appearance of a single one opening along the middle.
2865. A portion of the frond of a Fern (*Blechnum occidentale*), in which the sori form in each lateral segment a double linear series bounding the median nervure, and each series furnished with a narrow continuous indusium.
2866. A portion of the frond of a Fern (*Pteris longifolia*), exhibiting an arrangement of the capsules of the germinal particles along the margin of the pinnæ or lateral segments, and covered by a continuous marginal indusium.
2867. A portion of the frond of a Fern (*Polystichum acrostichoïdes*), in which the sori are round and covered by a circular indusium attached by its centre. The sori are crowded in this species, and by age appear confluent.
- 2867 A. A portion of the leaf of a Fern (*Acrostichum alaicorne*), exhibiting its reticulated venation, and the sporular capsules diffused over the posterior surface and destitute of an indusium.

*Presented by Sir Everard Home, Bart.*

2868. A branch of a Fern (*Osmunda regalis*), in which the pinnæ at the summit of the frond are modified, contracted, and bear clusters of sori, composed, as in the preceding specimens, of sporuliferous capsules, which are destitute of a ring, and are reticulately vascular.
2869. A portion of the frond of a Fern (*Onoclea sensibilis*), in which the fruit-bearing or fertile fronds are greatly contracted, and their edges rolled inwards and united, so as to inclose the sori, which are furnished with a proper indusium of a very delicate texture.
2870. The summit of the stem of the Knee-holly (*Ruscus aculeatus*), showing the position of the fruit upon the leaf-like peduncle. The apparent stem in this plant appears to be only a modified floral axis. In *Ruscus andro-*

*gynus* the rachis of the raceme is still more expanded, and presents entirely the aspect and performs the functions of the true leaves, which in this genus are reduced to mere scales : each fruit is enveloped by the withered sepals.

2871. A specimen of the simple fruit, or 'utriculus' of the Amaranth or Prince's feather (*Amaranthus hypochondriacus*). It is one-celled, and the pericarp is membranous and dehiscent by a transverse incision.
2872. The fruit, or 'drupe' of the Plum (*Prunus domestica*). It contains but a single hard and brittle, one-seeded, indehiscent carpel ; one half of the soft and fleshy outer coat, or 'sarcocarpium,' is removed to show the hard inner coat of the seed or stone, called 'endocarpium.'
2873. A portion of the Larkspur (*Delphinium pictum*), exhibiting several of the seed-pods or 'folliculi,' developed in groups of three in each flower. Each follicle is one-valved and one-celled, but contains many seeds, which are attached along each margin of the suture by which the follicle is dehiscent or splits open to discharge the seeds.
2874. The fruit, or 'pericarpium,' of the *Nigella Damascena*. This consists of a collection of several concrete folliculi in a single flower : each of these follicles, like those of the Larkspur, is one-celled, and one-valved. The seeds are numerous and attached in two rows, one to each margin of the suture by which the cell is dehiscent. This genus is one of the few plants of *Ranunculaceæ* with a syncarpous fruit.
2875. A portion of the stem of the yellow Lupine (*Lupinus luteus*) with the 'legumen' or seed-pod, of which one valve has been removed, showing the separate cavities for the seeds formed by septal processes or projections of the placenta ; the seeds or ovula have been bisected to show the cavity in each, which contains the embryo.
2876. A twig of the Bladder Senna (*Colutæa arborescens*), with two seed-pods or legumens ; these are each two-valved, one-celled, many-seeded, superior, and dehiscent by a suture along both the anterior and posterior margins. One of the valves has been removed from each legumen to show the numerous ovula or seeds which are attached by long umbilical funiculi to the margin of the inferior or ventral suture.

2877. A portion of the stem with several fruits of *Agrimonia Eupatoria*. The ovaria are distinct, inclosed in the persistent tube of the calyx, which is fringed with hooked bristles.
2878. A section of the hip or fruit of a Dog-rose (*Rosa canina*), showing the distinct ovaria, each inclosed in a hard and indehiscent pericarp; the whole being surrounded by the fleshy tube of the calyx, which is lined by the torus or floral disk.
2879. A section of the stem bearing the female spike, consisting of longitudinal series of the fruits, or 'caryopsis' of the Maize (*Zea Mays*). The rachis or axis is not dissected, but the number, aggregated and regular positions of the fruits and the stigmata, which are the longest known in the vegetable kingdom, are worthy of notice.
2880. The stem of the Bladder Alyssum (*Vesicaria utriculata*), with specimens of the fruit attached: a portion of the pericarp has been cut away on each side to show its two-celled structure, and the transparent dissepiment, by which the cells are separated.
2881. A portion of a twig with two groups of the fruit consisting of five concrete carpels of the Fraxinella (*Dictamnus Fraxinella*): one carpel is laid open, showing the thick soft coarsely villous outer coat, and the thin smooth inner coat or endocarp; the seeds are pendulous, and attached to the upper margin of the carpel.
2882. The terminal portion of the stem of *Thlaspi arvense*, with several of its flattened, two-celled fruit or 'silicula.' In one of the larger siliculæ the act of dehiscence has commenced by the two valves beginning to separate from the septum. The seeds, which are not numerous, are attached to two placentæ adhering to the septum, and opposite to the lobes of the stigma.
2883. A portion of a stem of the Mignonette (*Reseda odorata*), with many of the fruits or 'capsules.' These are dry, many-seeded, unilocular, three-valved, and with three parietal placentæ, to which the ovules are attached. The ovaria are constantly open at their summits.
2884. The terminal portion of a stem of *Antirrhinum majus*, with several of



the capsules attached. These are peculiar for their mode of bursting, which is by two terminal foramina. The placentæ are large and the seeds very numerous and minute.

2885. A specimen of the fruit or capsule of the *Datura Stramonium*; the valves of two of the cells have been removed, showing the seeds and their placental attachments.
2886. A longitudinal section of the umbel and fructiferous stem of the Onion (*Allium Cepa*). The flowers are supported on long and slender pedicels, which radiate from the contracted floral axis.
2887. The umbel or floral axis of the Onion, with several of the flowers removed, showing the 'bulbilli' at their base.
2888. The bulbiferous 'umbel' of the Garlic (*Allium sativum*).
2889. Several specimens of the fruit of the Nutmeg (*Myristica moschata*). Some are entire; from others half of the fleshy and valveless sarcocarp has been removed to show the multipartite 'arillus,' commonly called mace, which surrounds the seed, and which is developed as an additional membrane after the fertilization of the ovule.
2890. One of the seeds of the Nutmeg, surrounded by the arillus, or mace, and a longitudinal section of another seed showing its indehiscent endocarp.
2891. A specimen of the calyx and fruit of the Blue Nightshade (*Nicandra physaloides*). The fruit is exposed by the reflection of two of the reticulate lobes of the calyx, which increases in size after fecundation: it consists of a thin, indehiscent pericarp, containing numerous seeds.
2892. A similar specimen in which a portion of the calyx and of the dry pericarp have been removed to show the ripe seeds in three of the cells.
2893. The calyx and fruit of the Winter-cherry (*Physalis edulis*), in which the calyx has been skeletonized or deprived of the cuticular and cellular tissues, so as to allow the ripe fruit to be seen within.
2894. The skeleton of the calyx of the Winter-cherry; the fruit has been removed.
2895. A specimen of the 'capitulum' or compound flower and fruit of the



*Scabiosa atropurpurea*: some of the flowers have been removed from the rachis or general floral axis. The fruit exhibits an adherent, one-seeded, one-celled, indehiscent pericarp; with the seed not cohering with the endocarp.

2896. A section of an Acorn, exhibiting one out of the six original ovules, and one out of the three primitive cells of the ovarium, in an advanced state of development; the single seed, which thus results from the atrophy or abortion of the other parts of the original compound fruit, is lodged in a hard involucre called the cupule, composed of several series of imbricate persistent bracts.
2897. A twig with a cluster of the fruit of the Filbert (*Corylus Avellana*). Here the one-celled and one-seeded fruit, which proceeds, as in the Oak, from an ovarium originally containing three cells and six ovules, is completely concealed by the gamophyllous tubular persistent involucre. The fruit of both the Oak and Hazel, technically called the 'glans,' besides the peculiarities attending its development, is characterized by being adherent, hard, and indehiscent.
2898. One of the ovaria of the Thistle (*Cirsium eriophorum*). It is chiefly remarkable for the imperfect development of the limb of the calyx, which, when partially decomposed, is resolved into the hair-like processes, or 'pappus'; and these being continued from the apex of the ovary, serve to spread abroad the seed, being sufficiently light to be carried to a considerable distance through the air, even with a moderate wind.
2899. The summit of the stem of *Campanula latifolia*, with flowers and fruit attached. The latter is compound, and is the type of the modification of fruit, called 'diplotegia' in the Carpological System of De Candolle; which differs, however, from the capsule only in being adherent to the calyx: this is chiefly remarkable in the present instance for rupturing by three foramina at its base.
2900. A portion of a branch with several fruit or 'pomes' of the dwarf Medlar (*Cotoneaster vulgaris*). The structure of this fruit agrees with that of the apple.
- 2900A. A specimen of the fruit of the Apple (*Pomum*). The seeds or pips are

inclosed in dry cells, with a hard membranous lining, formed by the cohesion of several carpels with the sides of the fleshy tube of the calyx which constitutes the edible part of the fruit. This modification of fruit is technically called 'pomum,' the apple affording the type.

The present specimens are stated in the Manuscript Catalogue to be part of 'a second crop.'

*Presented by Mr. Clift*

2901. A section of the fruit of the Melon (*Cucumis Melo*). This fruit, which is technically termed 'peponida,' is one-celled, many-seeded, inferior, fleshy and indehiscent. The seeds are attached, at a distance from the axis, by pulpy placentæ to the fleshy parietes of the pericarp; and in the present case the cavity of the pericarp is filled with pulp, in which the numerous seeds are imbedded.

2901A. A section of the fruit or 'balausta' of the Pomegranate (*Punica Granatum*), exhibiting its double series of many-seeded cells; the seeds have a pulpy coat, but are attached distinctly to their placentæ; the pericarp is adherent and indehiscent.

*Prepared by Mr. Owen.*

2901B. A twig with specimens of the fruit of the *Avicenna tomentosa*. It is remarkable for the extent to which the germination of the embryo proceeds while the fruit remains attached to the parent plant; the process being analogous to the viviparous generation in animals.

*Presented by Henry Salt, Esq.*

2902. A branch with male and female flowers and fruit of the Scotch Fir (*Pinus sylvestris*). The fruit of this and of other species of Pine is principally characterized by modifications of the placentæ: the carpella, which are developments of the placentæ, are here scale-like, spread open, and bear naked seeds. The flower of the fir is called an amentum or catkin: it is destitute of a calyx and corolla, being furnished only with bracts.

2903. A portion of a stem, with several of the fruit or 'sorosis' of the *Broussonetia papyrifera*. This modification of fruit is characterized by the cohesion, in a single mass, of the ovaria and floral envelopes.

2904. A similar specimen,

2905. The seed and embryo of the yellow Lupine (*Lupinus luteus*). The radicle or future root is the descending part ; it is continued from the cauliculus. A portion of the outer integument of the seed is removed to show the cotyledons which protect the young plumule, or primordial bud.
2906. The germinating embryo of the yellow Lupine, with the cotyledons divaricated to show the plumule.
2907. The embryo of the yellow Lupine (*Lupinus luteus*) showing the progress of germination towards the end of the first week. The cauliculus, or first portion of the ascending process, and the radicle, are much elongated. The plumule has begun to rise above the protecting cotyledons.
2908. The cauliculus and a portion of the radicle of a Lupine (*Lupinus hirsutus*), showing its finely-ciliated surface.
2909. The embryo of the yellow Lupine (*Lupinus luteus*) in which germination and the development of the plumule, more especially, is further advanced.
2910. A similar specimen.
2911. The seed and embryo of a Pea (*Pisum sativum*) in which germination has pretty far advanced. The wrinkled and partly-collapsed state of the seed indicates the exhaustion of the farinaceous and nutritious contents of the cotyledons consequent upon the development of the radicle and plumule.
2912. The seed and embryo of the common Bean (*Faba vulgaris*) : one half of the 'testa' has been removed, exhibiting the exterior of the cotyledon of that side : germination has commenced, and the radicle has protruded through the testa and begun to shoot downwards. Above the radicle may be seen the line of division between the exposed and covered cotyledon.
2913. The seed and embryo of a Bean in which germination is more advanced, the radicle descending, and the plumule ascending, but without any corresponding ascent of the cotyledons, which remain buried in the earth during the whole period of germination, and are therefore called ' hypo-



geous.' The rootlets, which are about to be developed, are recognizable by their opaque white colour and slight projection from the radicle.

- 2914. A similar preparation, showing a more advanced stage of germination. The accessory or secondary rootlets now extend from the base of the primary radicle.
- 2915. A similar preparation, exhibiting further development of the radicle and plumule.
- 2916. A similar preparation, in which the development of the embryo is so far advanced as to be independent of the nutriment afforded by its amylaceous appendages. A section has been removed from the seed to show the change which has taken place in the hypogeous cotyledons during the progress of germination; they now present a dark-grey colour, and coarsely-granular, dry texture : the fecula in their cellular tissue having disappeared, and been consumed in the support of the germinating embryo.
- 2917. The seed of the Chestnut (*Castanea vesca*), containing two embryos ; each of which has developed its radicle and plumule. The external coat of the common enveloping membrane or 'testa,' is reflected from one side of the seed.
- 2918. The seed and polycotyledonous embryo of the Stone-Pine (*Pinus Pinea*), showing the radicle and the verticillate cotyledons, which are still partly enveloped by the testa.

The following six preparations were subjects of the experiments instituted by Hunter, to determine the principle upon which the radicle and plumule of the germinating plant take definite and opposite directions in their growth ; the one proceeding centripetally or downwards in the soil, the other centrifugally or towards the surface.

"That this is a general principle in vegetation" he observes, "requires no illustration, but what is the immediate cause is not so easily determined. I conceived it might be the light, not warmth, for the ground is often warmer than the air, or surface, into which vegetables are often growing. To ascertain this, as far as I could, by experiment, I took a tub, about eighteen

inches deep, and about two wide, and filled it with fine mould, in which I planted some Beans and Peas; their eyes were placed in various directions, and over the surface was placed a close-meshed net. The mouth of this tub was turned down, was raised about three feet from the ground, and was suspended between two posts. Round the tub, and over its bottom, which was uppermost, were placed wet straw, mats, etc., to take off any influence the sun or air might have upon its contents, and a small hole was bored in its bottom, to which was fixed a small long tube that came through the straw. This was intended for pouring some water, if I found the earth get dry, into the tub. Under the mouth of the tub I placed looking-glasses, in such a way that the light was thrown upon the mouth of the tub, or surface of the earth. The weather was fine, so that through the whole day there was the reflection of the light from the looking-glasses upon the surface of the mould, which was much more powerful than daylight without the direct rays of the sun. This I continued till I conceived that the Beans and Peas had grown some length, but not finding their tops coming down through the surface of the mould, I examined the contents of the tub, and found that they had all grown upwards, towards the bottom of the tub, and that in those whose eyes had been placed downwards the young shoot had turned round to arise up. As one experiment leads to another, I wished to see how a Bean would grow if kept in a constant rotatory motion. For this purpose I put some earth in a basket, having the shape of a cylinder, and about a foot diameter, with the two ends of wood for greater strength, through the centre of which I fixed an axis or spindle; in this earth I planted a Bean, about half-way between the surface and axis, with its eye to the surface. The basket was laid across the mouth of a large tub, with the ends of the spindle resting on the edges of the tub, which were fitted to one another so as to allow of easy motion. Round the basket was rolled some small cord, to the end of which was suspended a box, water-tight; into this was put lead, so as almost to make it sink in water, and which was sufficient to turn the basket round in the open air. This large tub was filled with water, and the box placed upon it, and the spindle with the basket placed across the mouth

of the tub ; a very small hole was bored at the lower end of the tub, which allowed the water to escape, but very slowly ; as the water sunk in the tub the box descended, and as the box descended the basket turned round. This tub took about twelve hours in emptying, and during that time the spindle with the basket only turned about one and a half : the tub was repeatedly filled, and when I conceived that the Bean might have grown some inches, if it had grown at all, I examined it, and found it had grown as much as if it had been planted in the common ground ; but it had no particular direction but that of passing in a straight line from the Bean, which was at first towards the circumference, the direction in which it was placed ; but in its course it had met with a small stone, which had turned it in the direction of the axis, and it had gone on in a straight line in that direction. Here, as there was no fixed inducement to grow in any one direction, the Bean grew in a straight line, in that direction given it by chance." *On the Blood*, 4to, 1794.

- 2919. The seed and embryo of a Bean, in which the foramen (.micropyle), or place of protrusion of the radicle, was directed upwards or towards the surface of the earth ; the growing radicle, as soon as it had extended beyond the resistance to its descent offered by the seed, has become bent downwards ; the plumule on the contrary has immediately ascended.
- 2920. A similar preparation, in which, from a change of position of the seed during germination, the direction of both plumule and radicle has been altered.
- 2921. A similar preparation, in which, from similar causes, both the plumule and radicle have twice changed the direction of their growth.
- 2922. A similar preparation.
- 2923. The seed and embryo of a Bean, in which the radicle, in consequence of some obstruction to its natural course of growth, exhibits a spiral curve. The testa has been removed from the seed, which exhibits the two cotyledons.
- 2924. A similar specimen, with the testa entire and germination farther advanced.  
Mr Knight observes, with reference to a similar direction of the



radicle, "The extremity of the radicle of the Bean, when made to point perpendicularly upwards, generally formed a considerable curvature within three or four hours, when the weather was warm."—*Phil. Trans.* xcvi., p. 106. There are no notes in the MSS. Hunterian Catalogues or other records, relating to the particular preparations above described, or indicating the circumstances under which they were severally made.

The experiments instituted by Hunter with the inverted box and mirror with reference to the influence of light, are equally conclusive against the theory that the root from the nature of its parts is attracted to the earth, as the seat of humidity, and that the stem turns to the atmosphere as a drier medium.

The subsequent experiments of M. Dutrochet, in which kidney-beans were so placed as to receive, as in those of Hunter, the influence of the atmosphere and light from below, were followed by the same results: the radicles descended, and escaping into the atmosphere, there dried and perished; the plumula ascended into the dark and moist earth above.

The second series of experiments, by which Hunter endeavoured to ascertain how far the germinating seed was influenced in its direction by mechanical causes, has likewise been repeated. Mr. Knight planted beans in a rotatory machine, but instead of the slow motion to which they were subjected in Hunter's experiment, the position of the germinating seeds with reference to the earth was inverted 150 times in a minute, and the influence of gravitation wholly suspended.

Under these circumstances the growth of the radicle was centrifugal, or from the axis of the wheel; the plumules, on the contrary, took the opposite direction, and in a few days their points all met in the centre of the wheel!

When the seeds were wheeled round on a horizontal plane, and were thus submitted to the influence of the centrifugal force as well as of that of ordinary gravitation, the oblique direction of the radicle and plumule showed that their growth had been influenced by both forces, and by the artificially generated force in proportion to the rapidity of the motion of the horizontal wheel: thus, when it carried round the

germinating seeds 250 times in a minute, the radicles pointed downwards about ten degrees below, and the plumules as many degrees above the horizontal plane of the wheel's motion. The radicles receded from, and the plumules approached to the axis of the wheel, as when it rotated vertically ; but the centrifugal force had caused both to deviate eighty degrees from the perpendicular direction each would have taken, had it vegetated at rest, or been only subjected to the ordinary force of gravitation.

## SERIES II. In Polypes.

2925. A Sea-Pen (*Pennatula phosphorea*, LINN.). The ova or gemmules are developed chiefly at the back part of the pinnæ or lateral processes ; many of them may be observed in this situation, where the integument is ruptured.

They appear to be developed, not in a distinct ovarium, but in the common connective, or cellular tissue of the part. It is believed that they are discharged by the mouths of the digestive sacs or polypes.

## SERIES III. In Entozoa.

- 2925A. Two of the joints of a Tape-worm (*Tænia Solium*, LINN.), in the inferior of which the dendritic ovarium is rendered visible by the opaque ova which are developed in its branches. *Prepared by Mr. Owen.*

## SERIES IV. In Acalephes.

2926. A Medusa (*Cyanæa aurita*, Cuv.), showing the 'gemmaria' turgid and opaque, from the number of the ciliated gemmules which they contain ; these present a yellow colour from the action of the spirit. The gemmaries are situated in the interspaces of the oral tentacles ; and open each by a separate ciliated orifice, on the central or inferior surface of the body.

### SERIES V. In Echinoderms.

2927. A Star-fish (*Asterias rubens*, LAM.), with the ventræ or inferior parietes of two of the rays dissected off, and the ramified ovarium and alimentary cæca displayed: the latter are *in situ*, and present a deep-yellow colour: the opaque and white ovaries are reflected downwards; they are turgid with ova. On the opposite side two other rays are laid open, the digestive cæca displaced, and the ovaria exhibited *in situ*.

2928. A Star-fish (*Comatula solaris*, LAM.). The ovaria are here much more numerous than in the *Asterias*, being situated in the pinnate processes of the rays.

The ova are exposed in this situation in the preparation, No. 2239.

2928a. A portion of the shell of an Echinus (*Spatangus purpureus*, LAM.), with the oviducal pores, and three of the ovaria and oviducts *in situ*; the latter are extremely slender; the ovaria present a compact racemose form.

*Prepared by Mr. Clift.*

### SERIES VI. In Cirripedes.

2929. A specimen of the common Barnacle (*Pentelasmis anatifera*, LEACH), with the outer horny elastic coat of the pedicle reflected; and the inner tunic slit open to show the ova in the substance of the pedicle.

2930. A specimen of the Vitreous Barnacle (*Pentelasmis vitrea*, LEACH), with the ova similarly exposed in the substance of the pedicle.

### SERIES VII. In Annelides.

2931. Specimens of the ova of the Earthworm (*Lumbricus terrestris*, LINN.).



SERIES VIII. In Mollusks.

2932. The ova, or 'spat' of the Oyster (*Ostrea edulis*); they are of extreme minuteness, and appear as a white sediment at the bottom of the bottle.
- 2932A. A similar specimen of 'mature ova of the Oyster.'  
*Presented by Sir A. Carlisle, F.R.S.*
2933. Several specimens of the ova of a Slug (*Limax ater*, LINN.).
2934. A portion of the viscera of a Snail (*Helix hortensis*, LINN.), showing several spherical ova in the terminal portion of the oviduct.
2935. Several ova of the *Helix hortensis* after exclusion from the oviduct.
2936. Several of the ova of a Snail (*Helix*), in which development has so far advanced that the form of the shell may be distinguished through the outer envelope.
2937. Ova of another species of Snail, in a similar stage of development.
2938. Ova of another species of Snail, far advanced in development.
2939. Ova of the *Helix Pomatia*, soon after their exclusion from the oviduct.
2940. Similar specimens, with development farther advanced, exhibiting the rudiments of the shell.
2941. Young specimens of *Helix Pomatia*, soon after their exclusion from the ovum.
2942. A specimen of viviparous fresh-water Snail (*Paludina vivipara*, Cuv.). The soft parts have been removed from their shell; and the large ova may be discerned through the transparent tunics of the oviduct.
2943. Three specimens of the same species of *Paludina*. In the upper one the shell has been removed, and the oviduct laid open and emptied of its contents: in the middle specimen, the embryo *Paludina*, with their rudimental shells, are exposed *in situ*: in the lower specimen the soft parts

are in the shell, from which a portion of the basal whorl has been removed to show the relative position of the uterine portion of the oviduct.

- 2943 A. A species of land Snail (*Bulinus*), with a cluster of its ova attached to a leaf.

*Presented by Hugh Cuming, Esq.*

- 2943 B. A cluster of the ova of the *Bulinus Melcagris* attached to one leaf and protected by a second, cemented over them by means of the mucous secretion of the mollusk, the leaves being thus converted into a kind of nest.

*Presented by Hugh Cuming, Esq.*

2944. A cluster of the nidamental capsules of the ova of an univalve mollusk (*Buccinum*, LINN.). They are oval, subcompressed, attached by a short pedicle, and truncate at the opposite or free extremity, on which is situated the transversely elliptical orifice leading to the interior of the nidus.

2945. The float of the *Janthina* (*Janthina fragilis*, LAM.), with a cluster of the nidamental sacs of the same mollusk. The float is formed by a secretion of albuminous matter disposed in the form of subcylindrical cells, aggregated together in an oblong mass, and filled with air: it is attached to the posterior part of the foot, being in situation analogous to the operculum of other Univalves, which is wanting in the *Janthina*. The chief destination of the float is to serve as a basis of attachment for the capsules containing the ova; and when their formation and disposition upon the float are completed, the latter is detached by the parent animal. The ova are thus buoyed upon the surface of the sea, where they are exposed to those influences, as the light and heat of the sun's rays, by which the development of the embryo mollusks is best promoted. The capsules are of a flattened pyriform or ovate shape, and composed of a delicate subreticulate film of albuminous secretion, prepared by a laminated nidamental gland near the termination of the oviduct.

2946. A similar but smaller specimen of the float and nidamental capsules of the *Janthina*.

2947. The nidamental capsule of an univalve mollusk. It presents a flattened, transversely oblong form, consists of a thin subtransparent amber-coloured

tissue, and contains about thirty embryos with the nucleus and first two whorls of their shells completely formed.

- 2947 A. Portions of decayed wood, to which are attached, in regular linear series, several of the nidamental capsules of the *Pyrgula Rapa*, LAM. These are of a flattened, subconical figure, attached by their apex, and with the base emarginate, and its angles produced; a ridge extends from each angle upon one of the sides of the capsule; the two ridges slightly converging as they proceed towards the base, and disappearing about one third of the way down. Each nidus contains numerous minute embryos with the shell sufficiently developed to exhibit its characteristic striations. *Presented by Geo. Bennett, Esq., F.L.S.*

2948. A cluster of the nidamental capsules of the Whelk (*Buccinum undatum*, LINN.): they are depressed, of an irregular oval figure, with one side convex, and the other flat or concave; they are attached by one or more parts of their margin: their external surface is irregularly striated; their internal surface smooth and formed by a thin and delicate membrane, to which numerous extremely minute ova are attached:—several of the capsules are laid open to expose these.

2949. A portion of Oyster-shell, to which several of the nidamental capsules of the same mollusk are attached: in some of these, which are laid open, the lining membrane is distinctly shown.

- 2949 A. The shell of a *Mya truncata*, with a cluster of the nidamental capsules of the same mollusk attached to the truncate extremity.

*Leverian Museum.*

- 2949 B. A species of Cowry (*Cypræa*, LINN.), with a cluster of its nidamental cells.

*Presented by Hugh Cuming, Esq.*

- 2949 C. A species of *Purpura*, LAM., with a portion of decayed wood, to which is attached a group of the nidamental cells of this mollusk.

*Presented by Hugh Cuming, Esq.*

2950. A group of eighteen nidamental capsules of a *Turbinella* superimposed and adherent to each other: they are of a flattened subpentagonal form, and contained each between twenty and thirty embryos. From two



to three whorls of the shell are completed in each embryo, and some have acquired both their characteristic sculpturing and colour.

- 2950 A. A Univalve Mollusk (*Ranella*, LAM.), with its nidamental cells. These are of an elongated, narrow, subcompressed form, about five lines in length, slightly contracting towards the free extremity, and attached by the opposite end to a band of condensed mucus.

*Presented by Hugh Cuming, Esq.*

2951. The remains of an elongate, reticulate, compound nidus of a Gastropod, attached to a fragment of a bivalve shell: only one of the component capsules is entire; the rest are broken open and the embryos have escaped.
2952. Two embryos of a Testaceous Gastropod.
2953. The ovary of a Cuttle-fish (*Sepia officinalis*, LINN.) laid open, exposing the reticulate calyces or ovisacs in different stages of development: in a few of the largest and darkest coloured the ova are mature.
2954. The ovary, oviduct, oviducal gland, and nidamental glands of a Cuttle-fish. The oviduct is distended with numerous mature ova, which have burst their calyces, and passed into that tube. A bristle is inserted into the excretory outlet of each of the detached nidamental glands, from one of which a longitudinal section has been removed to expose its compact laminated structure.
- The ovum, consisting of the germ, the yolk and the vitelline membrane, is invested by successive layers of inspissated albumen, as it traverses the short and wide oviduct, and the cortical membrane or chorion is formed by the terminal gland. After quitting the oviduct, the ovum is closely surrounded by a nidamental investment, and provided with the filamentary appendage by which the parent attaches it to the appropriate foreign body.
2955. A cluster of the ova of the Cuttle-fish, attached by the filaments secreted by the nidamental glands to a portion of vegetable substance. The nidamental, cortical, and amniotic membranes have been removed from one of these ova, and the embryo is exposed.

2956. A cluster of the ova of the Cuttle-fish, similarly attached by their nidamental pedicles, which are twined around the stem of a fucus.
2957. A small cluster of the blanched and semitransparent ova of the Cuttle-fish, in which the embryo, far advanced in development, and with its appended orange-coloured yelk-bag, may be discerned in each ovum.
2958. Three ova of the Cuttle-fish in a similar condition, exhibiting their contained embryos.
2959. An ovum of a Cuttle-fish, laid open, exposing the embryo and its yelk-bag, or vitelline sac: the pedicle of the latter appendage, instead of being attached to the abdominal surface, passes to the head and descends along the anterior part of the mouth and gullet, to communicate with the stomach. This communication is permanently indicated by the anterior cæcal pouch of the crop in the Poulp (*Octopus vulgaris*, Cuv.).
2960. The embryo of the Cuttle-fish, and its vitellarium separately displayed.
2961. The embryo of the Cuttle-fish further advanced, and the diminished vitellarium, with the place of attachment of the vitelline duct exhibited.
2962. The embryo of a Cuttle-fish, at nearly the full period of development, from which the ventral parietes of the abdomen have been removed to show the fully developed ink-bag, the branchiæ, the infundibular valve, and articular cavities: the lateral fins are also completed.
- 2962 A. The ovary, oviduct, and nidamental glands of a Cephalopod (*Rossia palpebrosa*, OWEN). The capsule of the ovary is removed to show the large ovisacs and ova in different stages of development, several of the latter being mature and ready to escape: the single oviduct contains three ova, which are nearly equal in size to those of the Cuttle-fish: four other ova, which had escaped from their calyces and passed into the oviduct, lie at the bottom of the bottle: they clearly exhibit the contrast between the smooth and polished surface of their outer tunic, and the finely reticulated membrane of the ovarian calyces. The oviduct is terminated by a pyriform laminated gland, which doubtless adds some covering to the exterior of the ovum; but the final nidamental investment and filamentary appendage, for the attachment of the ovum to a

foreign body, is prepared by the two large laminated nidamental glands, which are exhibited in nearly their natural relative position with the termination of the oviduct.

*Prepared by Mr. Owen.*

- 2962 B. Three ova of the *Rossia palpebrosa*. One is included in its reticulate calyx; half of this covering has been dissected away from the second; the third exhibits the condition of the ovum after it has passed into the oviduct.

*Prepared by Mr. Owen.*

- 2962 c. A group of the chaplets of ova of the sagittated Calamary (*Loligo sagittata*, Cuv.). From fifty to a hundred of the ova of this cephalopod are enveloped in a common nidamental covering, and numerous strings of ova thus packed together, are excluded by one female, and attached to some foreign body.

*Presented by John George Children, Esq., F.R.S.*

- 2962 D. A cluster of the small ova of the Paper Nautilus (*Argonauta Argo*, LINN.). These ova are connected together in groups by means of extremely delicate and short pedicles; they are relatively much smaller than in the *Loligo* and *Sepia*.

*Presented by Mad. Jeannette Power, Corr. Member, Z.S.L., &c. &c.*

- 2962 E. A female Paper Nautilus (*Argonauta Argo*, LINN.), showing the ova lodged in the posterior involuted cavity of the shell, which serves an office in the generative œconomy of this mollusk analogous to that of the marsupial pouch.

*Purchased.*

- 2962 F. A similar specimen of the same species of Argonaut, exhibiting the ova in the posterior part of the shell farther advanced in development.

*Purchased.*

- 2962 G. A small Argonaut (*Argonauta hians*, Sol.). The Cephalopod has been removed from its shell, to show the cluster of minute ova which it has deposited in the posterior part of the shell, beneath the involuted spire. The ova of the *Argonaut* and *Octopus* are characterized by the minute size here exhibited.

*Presented by Fred. Bennett, Esq., M.R.C.S.*



### SERIES IX. In Insects.

2963. A specimen of the Flesh-fly (*Musca carnaria*, LINN.), with the ventral parietes of the abdomen dissected away, to show the ovaria and oviducts *in situ*.
2964. One of the flattened circular packets of ova of the Flesh-fly.
2965. A Flesh-fly, with the abdomen laid open, and two of the packets of ova removed from that cavity, showing the development which they undergo while retained in the oviduct of this larviparous insect.
2966. A similar specimen, in which the young larvæ are exhibited, regularly arranged parallel to one another, and ready to be extruded when a fit nidus has been found by the parent. By virtue of this ovo-viviparous modification of insect-development, the Flesh-fly is enabled to retain her brood longer than most other species, and to deposit them in a condition capacitating them for commencing the destruction of the putrescent substances which they are destined to re-organize, without loss of time.
2967. Several specimens of the larvæ of a small Gnat (*Culex*, LINN.). They pass this stage of their existence in water, and are provided with two fringed branchial appendages.
2968. The pupa of a Gnat.
2969. Several specimens of Mosquito, in the imago state.
- 2969 A. Several Gnats in the pupa and imago states. At the period of the final change or transition into the last state, the pupa, which is usually suspended vertically in the water, now raises its lower end and stretches it out upon the surface, above which its thorax is elevated: this part is then split between the two respiratory horns, and through this aperture the anterior part of the gnat emerges. In this state it floats freely on the surface of the water, the pupa case serving as a boat, until it finally liberates itself, and, its wings having become expanded, it traverses a new element and commences a new existence. *Presented by Mrs. Robinson.*

2970. A section of the skin of a Rein-deer containing the nidi of three Breeze-flies (*Æstrus Tarandi*, LINN.). A portion of one of these nidi has been cut off, the better to expose the anterior extremity of the contained larva, which, like that of most dipterous insects, is 'ecapitate,' or without a distinct scaly head.

2971. A section of the skin of a Rein-deer, showing an empty nidus of the *Æstrus Tarandi*.

The instrument by which the female *Æstrus* pierces the tough skin of deer and cattle is a horny tube consisting of four pieces, which, like the joints of a telescope, are retractile within each other. The last segment terminates in five points, three of which are longer than the others, and hooked; when united together, they form an instrument like an auger, only, having these points, it can bite with more effect.

2972. Two specimens of the young shoot of a Fir-tree converted, by the irritation of the ova and larvæ of the *Aphis Abietis*, into a gall, resembling one of the fir-cones, or a miniature pine-apple. A longitudinal section has been removed from the upper gall, showing its compact solid structure, and the cavities in it containing the larval aphides.

2972 A. A twig of a Fir showing four similar galls of different sizes: the structure of the largest and the contained ova are exhibited by a longitudinal section.

*Presented by Sir Everard Home, Bart.*

2973. A twig, with some leaves of the black Poplar, exhibiting galls developed on the leaf-stalks, in consequence of the presence of the ova and brood of the *Aphis bursariæ*. These galls present a somewhat angular form.

2974. A leaf of the Willow, with several tubercles developed in its cellular parenchyma, in consequence of the irritation of the ova of some insect.

2975. A twig of the common Wild Rose, from the extremity of which a large tuft of moss-like fibres has shot out, in consequence of the irritation induced by the presence of the ova and larvæ of the *Cynips Rosæ*. A section of this abnormal vegetative growth has been made, by which several of the nidamental cavities are laid open, and their smooth inner surfaces, with the inclosed small white larvæ, are exposed to view. The

surrounding tuft was called by the older Naturalists 'bedeguar,' and was esteemed a valuable medicinal substance.

- 2975 A. The leaf of a Lime-tree, to the upper surface of which are attached numerous fusiform galls or nidi of a Lepidopterous Insect: they are attached by their obtuse end, and terminate at the opposite end in a fine point. *Presented by Sir Everard Home, Bart.*

[The following preparations to No. 3038 inclusive, are all from the same species of moth.]

2976. Unimpregnated ova of the Silk-worm Moth (*Bombyx Mori*, LATR.), soon after extrusion, adherent by their glutinous exterior to a portion of card.
2977. Impregnated ova of the Silk-worm Moth, showing different stages of the development of the larva.
2978. A similar preparation. The larvæ have been excluded from some of the ova.

The three preceding preparations illustrate the experiments by Hunter, on the impregnation of ova, quoted at p. 115, vol. iv. *Physiological Catalogue*.

2979. Several larvæ of the Silk-moth, in different stages of growth, from the period of exclusion until they have attained an inch in length.
2980. A full-grown larva of the *Bombyx Mori*, or Silk-worm.
2981. A full-grown larva, dissected so as to display the principal parts of its anatomical structure. A longitudinal incision has been made immediately above the spiracula or breathing pores of one side, and the integument has been reflected from off the dorsal aspect of the body, exposing the straight and wide alimentary canal *in situ*, with the small white secerning tubes attached to the parietes of its posterior part. By the side of the intestine the convoluted tubes which secrete the silk are shown. The longitudinal dorsal vessel, or heart, is attached to the reflected portion of integument.
2982. A full-grown larva, with the integument removed from the right side of the body, showing the silk-gland of that side, the alimentary canal and biliary tubes.



2983. A full-grown larva, dissected to show the alimentary canal *in situ*, and especially the magnitude of the gastric portion or stomach, at the period of the larva's greatest voracity.
2984. A Silk-worm near the close of its larva state, when it has ceased to feed, dissected to show the remarkable diminution of the size of the stomach.
2985. A Silk-worm, at the active period of larval life, with the ventral parietes longitudinally slit open and divaricated, to show the 'sericteria' or silk-secreting glands *in situ*: they are of a relatively small size and pale colour.
2986. A Silk-worm, towards the close of its larval stage, with the abdominal walls dissected from off the dorsal and lateral aspects, to show the commencing enlargement and functional activity of the sericteria; the dilated or secerning portions of which are beginning to be distended with the dark albuminous material of the silk.
2987. A Silk-worm, at the period when it is about to commence the fabrication of its cocoon, with the abdominal parietes removed from the left side, showing the full development of the sericteria, and the whole course of their slender excretory ducts, to their termination in the filiform organ or spinneret at the middle of the under lip.
2988. The dilated or glandular portions of the sericteria: these tubes are, essentially, developments of the salivary system of secerning glands, and consist of two thin transparent membranes,—the outer fibrous, the inner glandular.
2989. A Silk-worm at the period when it has formed its cocoon, removed from that receptacle, and dissected to show the diminutive size of the sericteria at the completion of their functional activity.

[The following eighteen preparations exhibit the progressive formation and changes in the cocoon or silk-pod, to the period of the exclusion of the Imago.]

The formation of the cocoon is thus described by Kirby and Spence: "Of the larvæ which inclose themselves in silk, the most familiarly known is the silk-worm: the cocoon of this consists exteriorly of a

thin, transparent, gauze-like coating, through the interstices of which can be seen an inner smaller oval ball of a more close and compact texture. The whole is, in fact, composed of one single thread, but arranged in two distinct modes. To form the exterior envelope, which is merely the scaffolding, by means of which the inner and more solid covering is constructed, the caterpillar, after fixing upon a space between two leaves, or twigs, or angles suitable for his purpose, begins by glueing one end of its thread to one of the adjoining surfaces. This thread it next conducts to another part and then fastens, repeating this process and interlacing it in various directions, until it has surrounded itself with a thin and closely-spun netting. In the centre of this, when contracted into a space sufficiently small, it lays the foundation of the interior cocoon. Fixing itself by its prolegs to some of the surrounding threads, it bends its body, and by successive motions of its head from side to side, spins a layer of silk on the side opposite to it: when this is of the requisite thickness, the larva shifts its position, and repeats the same process in another quarter, covering each layer in turn with a new one, until the interior cavity is reduced to the size desired. Thus, the silken thread which forms this new cocoon is not, as might have been supposed, wound insularly, as we wind the thread of a ball of cotton, but backwards and forwards in a series of zigzags, so as to compose a number of distinct layers. Malpighi could distinguish six of these layers, and Reaumur suspects there is often a greater number. The former found the length of the thread of silk composing them, when wound off, without including the exterior case, to be not less than 930 feet; but others have computed it at more than a thousand, consequently the threads of five cocoons united would be a mile in length.

Estimating by the weight—the thread of a pound of cocoons, each of which weighs about two grains and a half, would extend more than 600 miles; and such is its tenuity, that the threads of five or six cocoons require to be joined to form one of the thickness requisite in the silk manufacture. It is the continuous thread of the inner cocoon which is most valuable; the outer loose coating, from its irregularity, cannot be wound off, and is known in commerce by the name of floss silk.”

2990. A larva of the *Bombyx Mori*, or silk-worm, commencing the formation of the loose exterior coating of its cocoon.
2991. A similar specimen, with the outer netting of the cocoon farther advanced.
2992. A similar specimen, showing the commencement of the formation of the compact inner case.
2993. A similar specimen, with the inner case well-defined: a marked diminution may now be observed in the size of the larva, the quantity of excreted material not having been replaced by any supply of nutriment from without.
2994. A similar specimen of the cocoon and larva.
2995. The thin, dense, compact, inner case or chamber of the cocoon, which is laid open to show the larva, about to cast its last skin and to pass into the pupa state.
2996. A similar preparation.
2997. A similar preparation, showing the silk-moth in the pupa state; the last larval skin, or mask, having been thrown off, and lying crumpled up by the side of the pupa.
2998. A similar preparation.
2999. A similar preparation, exhibiting an advanced stage of the transformation of the pupa; the exuvial integument of which has been worked down towards the bottom of the cocoon.
3000. A similar preparation.
3001. A similar preparation, showing the imago in the condition preparatory to commencing its escape from the cocoon.
3002. A cocoon, through the inner case of which the imago has eaten a round hole and has protruded its head.
3003. A similar preparation, with the act of extrication farther advanced.
3004. The imago, with the cocoon from which it has just emerged.
3005. A deserted cocoon of the silk-moth.



- 3006. A vacated cocoon of the silk-moth, showing the form and position of the aperture by which the imago has escaped.
- 3007. A deserted cocoon of the silk-moth, laid open to show the exuvial remains of the pupa.
- 3008. A larva and a pupa of the silk-moth.
- 3009. A larva, near the completion of that stage of existence when it is about to cast its skin, which is beginning to open at the back.
- 3010. A larva about to pass into the pupa state ; with its last skin loose and ready to be shed : one-half of it has been removed to show the pupa within.
- 3011. The pupa or chrysalis of the silk-moth, enveloped in its pupal integument or 'puparium.'
- 3012. The pupa, with the pupal exuvium shed, but remaining attached to the anal segment.
- 3013. The pupa removed from its puparium, to show the commencing development of the wings, and other characteristic external parts of the imago.
- 3014. The pupa in the state of ecdysis, with the wings, legs, and antennæ of the imago farther advanced in their formation.

[The eight following preparations show the progressive development of the external organs of the Imago, to the perfect formation of the Silk-moth.]

- 3015. A pupa, with the rudimental wings of one side removed.
- 3016. A similar specimen, at a more advanced stage of development.
- 3017. A similar preparation, with the pupal exuvium removed from one side of the head to show the rudimental antenna, and the disappearance of the horny lateral mandible, which was adapted to cut and tear the leaves on which the voracious larva fed, but has now given place to the suctorious organ termed 'antlia,' formed chiefly by the elongated maxillæ.
- 3018. A male imago.
- 3019. A similar specimen farther advanced in its development.

3020. A female pupa, with the wings half developed: the ova which distend the abdomen may be seen through the transparent parietes of that cavity.
3021. A fully developed female silk-moth, ready for oviposition.
3022. A similar specimen.

[The ten following preparations exhibit the changes and development of some of the internal organs of the Silk-moth during the pupa state.]

3023. The pupa with the ventral parietes removed from the back of the abdomen to show the shortened stomach and the commencing elongation of the slender intestinal canal.
3024. The right moiety of a longitudinally bisected pupa, showing the elongated intestinal canal, bent in a close fold upon itself.
3025. A male pupa, with the abdominal cavity longitudinally slit open, showing the alimentary canal and the two testes in the form of small white glandular bodies, situated near the posterior third of the alimentary canal: they are closely approximated to each other in their natural position.
3026. A male pupa, farther advanced, exhibiting the fusion of the originally distinct testes into a single glandular body.
3027. A female pupa, with the ventral parietes of the abdomen removed to show the rudimental tubular ovaria.
3028. A female pupa, somewhat farther advanced, with the ovarian tubes displayed from the dorsal aspect.
3029. A female pupa, at a more advanced stage, dissected to show the development of the seminal reservoir or 'spermatheca'\*, in addition to the ovarian or essential parts of the productive generative system.
3030. A female pupa, still more advanced, with the ventral parietes of the abdomen removed to exhibit the increase of length of the ovarian tubes, and the completion of the contained ova; many of which have fallen to the bottom of the bottle.

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\* See No. 2604 and *Note*, vol. iv. p. 115.

3031. A more advanced pupa, with the ovaria and fully formed ova displayed *in situ*.
3032. A female imago or perfect Silk-moth, with the dorsal parietes of the abdomen removed to show the ovarian tubes and ova *in situ*.
3033. A similar specimen, with the abdomen laid open from the ventral aspect, and the ovarian tubes turned down.
3034. A female Silk-moth similarly dissected.
3035. A female Silk-moth, with the ovarian tubes similarly but more completely displayed.
3036. A female Silk-moth, exhibiting the accessory organs of generation, called the 'spermatheca', and 'colleterium'. The former is the large vesicle with thin semitransparent parietes, part of which have been removed; the latter is the small bilobed opaque gland situated between the spermatheca and the expanded rectum; it is analogous to the nidamental glands of the mollusks, and secretes the adhesive varnish by means of which the eggs adhere to foreign bodies.
3037. A female Moth, with the ventral parietes of the abdomen removed, to show the ovarian tubes and ova *in situ*.
3038. A female Puss-moth (*Cerura Vinula*, LATR.) similarly laid open, but with a great part of the ovarian tubular apparatus and the intestinal canal dissected away, in order to expose more clearly the spermatheca and colleterium: both these accessory glands here present the form of pyriform sacs; the latter may be distinguished by its thicker and more opaque parietes.
3039. A female of the small Purple-barred Moth (*Noctua nupta*, FABR.), with the right wings and corresponding walls of the abdomen removed, showing the ovarian tubes, partly *in situ*, partly displaced and turned down: they exhibit the ova arranged in the usual linear series.
3040. A female Poplar Hawk-moth (*Smerinthus Populi*, LATR.), with the ventral parietes of the abdomen removed, and the ovarian tubes, with the linear series of contained ova reflected downwards.



3041. A female Privet Hawk-moth (*Sphinx Ligustri*, LINN.), with the ovarian tubes and ova displayed.
3042. Portions of the ovarian tubes and ova of another species of Hawk-moth.
3043. The female of a species of Hawk-moth (*Smerinthus*), with two of the leaves to which she has attached several of her ova. This is the most common situation of the ova of Lepidoptera, especially in those species which oviposit in summer, and in which the larvæ are excluded before the fall of the leaf.
3044. A portion of the stem of a vine with numerous ova of a *Bombyx* or *Sphinx* attached in closely aggregated longitudinal rows.
3045. Two portions of twig with chaplets of the ova of the Lackey-moth (*Lasiocampa Neustria*, LEACH) twined around them in a spiral manner.
3046. Two portions of oak-twigg, with the ova of the Egger-moth (*Lasiocampa Quercus*, LEACH), similarly arranged and attached to the bark. They are laid in autumn, and are not to be hatched until the spring; so that besides being independent of the fall of the leaf, by this mode of oviposition the eggs derive the benefit of the steady temperature of the living vegetable bodies to which they are attached.
3047. Numerous ova and larvæ of a Moth (*Bombyx*). The ova have a shining exterior, and are inclosed in a silken covering secreted by the parent moth. The larvæ are minute and very hairy.
3048. The larva of the Goat-moth (*Cossus ligniperda*, FABR.), laid open along the ventral aspect, and all the viscera removed, excepting one of the silk-tubes and the short intestine.
3049. The capacious alimentary canal of the voracious larva of some large Lepidopterous Insect: the white capillary tubes attached to the side of the stomach, and opening into the small intestine, are the hepatic organs.
3050. The alimentary canal and silk-glands of the larva of a large Moth. The termination of the long and slender ducts upon the lower lip, and the conical spinneret by which the secretion is moulded into the thread of

requisite fineness, and applied in due direction for the manufacture of the cocoon, are well displayed.

- 3051. Two portions of twig, between which is situated the cocoon with the larva of the Wood Leopard-moth (*Zeuzera Æsculi*, LATR.).
- 3052. The hairy larva of the Tussock-moth (*Larva pudibunda*, LEACH).
- 3053. The larva of the *Papilio Piera*, LINN.; it is characterized by a still more remarkable development of long silky hairs from the circumference of each segment.
- 3054. The larva of a large exotic *Bombyx*: it is ornamented by numerous spots, which reflect an iridescent lustre.
- 3055. The larva and pupa of the Cabbage Butterfly (*Pieris Brassica*).
- 3056. The pupa of a Butterfly pendent from a leaf; the external surface of the pupa-case reflects rich metallic and iridescent tints, whence the name of 'chrysalis' usually given to this modification of the pupa or passive stage of an insect.
- 3057. The chrysalis of another species of Butterfly presenting a similarly lustrous exterior.
- 3057 A. The chrysalis of a Butterfly of Ceylon, from which similar hues are reflected from certain points only of the outer case.  
*Presented by Dr. John Davy, F.R.S.*
- 3058. A lustreless chrysalis of another species of Butterfly.
- 3059. A portion of the branch of a tree with the cocoon of the larva of the small Eggar-moth (*Eriogaster lanestris*, LEACH). Besides the numerous larvæ which undergo their metamorphosis in the extensive cocoon which they weave in common, there are here preserved the pupæ and a few specimens of the imago.
- 3060. The larva of a large Hawk-moth, probably *Acherontia Atropos*.
- 3061. The pupa of a Death's-head Hawk-moth (*Acherontia Atropos*, OCHSHEIMER), from the right side of which the pupa-case has been dissected off to show the nascent organs of the future imago, upon which the outer case is moulded. The long proboscis, afterwards spirally coiled, is now

bent closely upon itself: the long antenna lies, anterior to the wing, in a groove between that margin of the wing and the second pair of legs: the legs are disposed in parallel lines and meet in front of the thorax. The pupæ, which are thus inclosed in a simple case, not divided into special compartments for the different members, were termed by Linnæus "pupæ obtectæ."

3062. A male Death's-head Hawk-moth in the imago state, with the ventral parietes of the abdomen removed to show the large single testis, situated behind the coil of intestine.

3063. A female Death's-head Hawk-moth, similarly dissected to show the ovaria *in situ*; only a portion of these tubular organs is thus displayed.

The sexual characters afforded by the antennæ and the anal segment of the abdomen may be noticed by comparing this with the preceding specimen.

3064. A number of glistening rounded oviform bodies, the production of some insect.

3065. Three of the ova of a Beetle belonging to the family "*Cerambycidae*."

3066. A female Chaffer (*Melolontha solstitialis*, FABR.), with the dorsal parietes of the abdomen removed to show the ovarian tubes and ova *in situ*.

3067. A female Chaffer (*Melolontha solstitialis*, FABR.), from which part of the ovarian apparatus with the contained ova has been removed, and is separately displayed.

3068. Two pellets of cow-dung, artificially rolled up by the Spring-beetle (*Scarabæus vernalis*, LINN.), in each of which it has deposited one of its eggs.

3069. Two of the pellet-shaped balls of the sheep's dung, in each of which the Spring-beetle (*Scarabæus vernalis*, LINN.) has deposited one of its eggs. In the districts where sheep are kept, this species of Beetle selects the ready-made balls afforded by the excrement of this Ruminant, and is at the trouble of artificially dividing the dung of the cow or horse into similar masses only where they are not naturally supplied.

3070. A female Rose-beetle (*Cetonia aurata*, FABR.), with the anterior parietes



of the abdomen removed, part of the ovarian apparatus displayed, and a group of ova therefrom separately exhibited.

3071. Three larva of the *Cetonia aurata* in different stages of growth : they pass this stage of their existence in decayed wood.
- 3071 A. A female *Cetonia* (*Cetonia chinensis*, FABR.), with the right parietes of the abdomen removed to show some of the large spherical ova *in situ* ; others, which have been removed from the ovarian tubes, are preserved in the same bottle. *Prepared by Mr. Owen.*
3072. The larva and its cocoon of a large exotic species of *Cerambyx* (LINN.). The outer wall of the cocoon is formed by portions of twig irregularly attached to each other by silken filaments, and the strong case, thus formed, is lined by a close and thick layer of fine and soft silk.
3073. A longitudinal section of the cocoon of the same larva : it is admirably adapted for strength, warmth, and concealment.
3074. The pupa of the great Stag-beetle (*Prionus cervicornis*, GEOFF.), exhibiting the commencing development of the thoracic segments and their locomotive appendages.
3075. The pupa of the Stag-beetle, with the development of the characteristic organs of the imago farther advanced.
3076. The pupa of the Stag-beetle, at nearly the same period of development, removed from the pupa-case. This case is expanded *pari passu* with the growth of the antennæ, trophi, and locomotive organs, and thus incloses them in separate and distinct sheaths ; but these consist of so tough a substance that the nascent organs within cannot be used until withdrawn. These pupæ, with detached but motionless limbs, were termed by Linnæus 'pupæ incompletæ.'
3077. The pupa of a Scarabæus.
3078. The pupa of the Dung-beetle (*Geotrupes stercorarius*, LATR.).
3079. The same, farther advanced towards the imago state, and removed from the pupa-case.
3080. A larva of the Palm-beetle (*Calandra Palmarum*, LATR.).

3081. A longitudinal section of the larva of the Palm-beetle, which has been taken and killed at the period of the ecdysis or moult.
3082. The pupa of the Palm-beetle.
3083. The imago of the Palm-beetle.
3084. A bundle of the cocoons of an Ichneumon of the subgenus *Microgaster* (LATREILLE).  
The ova of this subgenus are deposited in the body of a caterpillar, and after passing there the larva state as entozootic parasites, feeding upon the adipose tissue of their victim, they spin cocoons, which are enveloped in the silky substance here exhibited.
3085. A cluster of the pupa-cases of an Ichneumon of the subgenus *Microgaster*.
3086. A similar cluster of the pupa-cases of the same species of *Microgaster*, with several of the perfect insects.
3087. The nidus of a group of pupa-cases of a *Microgaster* allied to the *Ichneumon glomeratus* of LINNÆUS: a section has been removed from one side of the nidus, showing the closely aggregated cells in which the final change in the series of metamorphoses of these insects takes place.
3088. Two groups of pupa-cases of a species of *Microgaster*, and a dried and shrivelled Lepidopterous larva, which has probably been the victim of the parasitically developed young of this species of Ichneumon.
3089. Several longitudinally ribbed cocoons of a species of *Microgaster*, attached to the inner surface of a portion of bark.
3090. Two wide elliptical pupa-cases of a true *Ichneumon* attached to portions of bark: the imago has escaped from each by a regular circular aperture at the upper extremity of the case.
3091. A portion of the twig of a rose-tree perforated by a series of the symmetrically arranged cells of the Saw-fly (*Tenthredo*, LINN.). The instrument with which the parent forms these receptacles for her eggs is a modification of the anal segment of the abdomen, which is produced into two filamentary appendages, toothed on each edge, and scored on

each of the flat sides : these instruments are worked alternately ; and while their vertical action is that of a saw, their lateral one has the effect of a rasp. When the cell is thus completed, the two saws are divaricated sufficiently to conduct the egg into it.

- 3092. Two Hymenopterous insects of the genus *Bembex* (LATR.), in the imago state.
- 3093. A fertile female, or queen Hornet (*Vespa Crabro*, LINN.), with the dorsal parietes of the abdomen removed, and the ovarian tubes unravelled and turned down, showing the great number and progressive development of the ova.
- 3094. A section of a Hornet's nest, with the marginal hexagonal cells laid open longitudinally ; some exhibiting the contained larvæ or pupæ, others empty.
- 3095. A similar preparation.
- 3096. A young larva of a Hornet, invested with a thin exuvial tunic.
- 3097. A full-grown larva of a Hornet, inclosed in the semi-transparent lining membrane of the cell.
- 3098. A full-grown larva of a Hornet in its cell.
- 3099. The pupa of a Hornet, and its cell or cocoon, which is divided transversely.
- 3100. The pupa of a Hornet ; removed from its cell.
- 3101. A tablet of ebony, on which are the remains, stained black, of the alimentary canal of the larva and pupa of the Hornet, to show the change which it undergoes in form and capacity in the transition from the devouring to the fasting states of the insect.
- 3102. A common Wasp (*Vespa vulgaris*, LINN.) in the imago state.
- 3103. Two portions of a Wasp's nest, with several larvæ, pupæ, and an imago.
- 3104. A portion of the nest of a social Hymenopterous insect, which has been suspended from the branch of a tree. Most of the hexagonal cells are open, and the progressive growth of the larva, from the small ovum



which is cemented to the bottom of the cell, to the pupa in the closed cell, is very clearly displayed.

3105. A similar preparation.
3106. Two Hymenopterans of the genus *Pelopæus*, one in the pupa, the other in the imago state.
3107. Three larvæ and an imago of the Mason-wasp (*Odynerus parietinus*, LATR.). This insect bores a cylindrical cavity from two to three inches deep in hard sand, and, cementing the detached particles into little oblong pellets, it arranges them round the entrance of the hole so as to form a tunnel, which is often not less than two or three inches in length. It is in these artificial subterraneous cells that the eggs are laid and the larvæ nourished. They may be found in this country in sandy banks exposed to the sun.
3108. A portion of a Wasp's nest, in which nearly all the hexagonal breeding-cells have been deserted.
3109. A similar preparation, showing the larval Wasps in different stages of growth.
3110. A portion of decayed wood, which has been perforated by the Carpenter-bee (*Megachile centuncularis*, LATR.). The long cylindrical burrow is laid open, and six nests or cells of this bee are displayed *in situ*.
3111. One of the cells of the Carpenter-bee (*Megachile centuncularis*, LATR.), removed from the burrow, and laid open longitudinally, to show the contained larva and its store of food. The cell has here been formed of the leaves of a rose.
3112. A similar specimen, showing the store of food, consisting of a conserve of nectar and pollen, prepared for the sustenance of the larva.
3113. The larva and its exuvial investment, of the Carpenter-bee.
3114. A similar specimen.
3115. One of the cells of the Carpenter-bee, laid open to expose the full-grown larva.

3116. A similar preparation, exposing the fully-developed or imago Carpenter-bee.
3117. A fertile female, or queen Humble-bee (*Bombus terrestris*, LATR.), with the ventral parietes of the abdomen removed to display the ovarian tubes *in situ*\*.

\* This and the seven succeeding preparations illustrate the following account of the generative œconomy of the Humble-bee, copied by Mr. Clift from a Hunterian manuscript:—

“ *Of the Humble-bee.*—This insect is a striking instance of the union of the different parts of nature with each other, each part acting immediately for itself, yet collecting for others, and each depending on another, making in the whole one uniform machine, although made up of many and various parts.

“ An early spring brings forth a vast variety of things upon which there is a vast variety of animals to live: it brings forth flowers, it also brings forth the Humble-bee, &c.

“ The history of this bee does not interest us nearly so much as that of the common bee, neither as to curiosity nor profit, therefore it is not necessary to be so circumstantial in the facts; for the Humble-bee does not deserve the admiration (when known) that we would naturally bestow upon it from a slight acquaintance; for there are some things we should suppose belong to its labours which in reality do not.

“ I imagine it is not so universal as the common bee, for it is not worth cultivating or transporting from one country to another. They have the same bee in Newfoundland, both the dark cross striped with brown, and the brown, and therefore it is probably a bee of a cold climate rather than of a warm one\*. They propagate there in the same manner as they do in Britain.

“ This genus† is the largest in size of the bee-tribe in this country, and probably every country may have its Humble-bee, and it may also be the largest in that country. They are male and female. The females are of two kinds: viz. queens which are annual, and labourers which are semi-annual, and which breed along with the queens, which is of course in the same year in which they are themselves bred; this I believe not to be the case with the queens, they being bred themselves too late to breed the same year.

“ They come nearer to the species of the common bee than to any of the others, considering the bee as a tribe, being composed of queen, male, and labourers; but there appears to be a gradation in

\* [This conjecture has been subsequently confirmed by the capture of a species of Humble-bee in the most northerly latitudes yet visited by arctic voyagers.—See Kirby’s Description of the Insects collected in Captain Parry’s Northern Expedition.—R. O.]

† I conceive this bee forms a genus even in this country: if they are all one species, then there are some varieties; but this I doubt, for no one hive has any variety, yet I could conceive that the Dun might be a variety. [Latreille has sanctioned the correctness of this opinion of Hunter’s by the formation of a distinct genus (*Bombus*, Latreille,) for the reception of the different species of Humble-bee.—R. O.]

### 3118. Three groups of the irregular suboval cells of the Humble-bee.

this tribe of insects, one leading into the other. Although there are bees whose size and shape entitle them to the term of Humble-bees, yet I shall consider none under this term but those which form a family, all the others coming under the appellation of 'Solitary Bees.' There are different species which go by the name of Humble-bees. The distinctions which would make us suppose there were different species are their size and colour, with a difference in the length of tongue or proboscis, but probably the colour is mostly to be depended upon. But this question of species is to be determined with certainty, every bee in a hive being of the same species, although we shall find great variety in size in the same hive, but then not in colour, shape, and length of proboscis. I believe the Humble-bee has the longest proboscis of any of the bee tribe, by which it can suck the honey from flowers whose cups are deep.

"In a hive consisting of one hundred and fifty-seven female Humble-bees, their proboscides were nearly all of a length, proportioned all to their size, but not of a very long kind. Long and short proboscides are common to both female and male; but I should suppose that the female of any one species has a longer proboscis than the male of the same species; for in the above hive, where there were only twenty-one males, the proboscides of these males were shorter, especially the sucker. The proboscis has a sort of fold-joint at the head, by which it can be considerably lengthened. It is the females, as also the female workers, similar to all the females of the bee-tribe, only that have stings, none of the males having any; and as it is the females only that are employed in the œconomy of the hive, it is only these that are furnished with weapons.

"The Humble-bee is more a defensive than an offensive animal. I believe they seldom attack, only sting when laid hold of, and their sting has very little effect either as to sensation or swelling. When attacked they throw themselves on their back by first raising one side, and also raising the legs of that side, and then they tumble over. They are very hardy, and labour in weather that the common bee will not go abroad in, and this is owing to their having but little store, and their heat much less than that of the common bee; and for the same reason they work much better in the evening than the common bee does, but not near so late as either the hornet or wasp; for they are not in constant employ in finding food for their young, as the young feed themselves, and they have store for immediate use for themselves and the young bees as they hatch. They will not admit of being removed from their first situation to another, for when removed with the whole hive, as also with all the bees, and confined under a shade for some days with their cells filled with honey-food, they gradually leave it, but do not seem to go back to their former situations, if it is distant half a mile; from which circumstance, and from all the labourers dying, and the queen leaving the hive in the winter, they are not capable of being domesticated. They are not fond of having their hives meddled with or disturbed, for then they appear to get lazy, and do not breed so fast, their combs or cells not answering any future purpose, not being what I have called the furniture of the hive, as in the common bee. From these circumstances they are much more liable to accident, as also from their mode of forming their hives, which is liable to many accidents.

"A wet season shall drown many hives, by being begun by a single bee, which is the mother of the colony, and which at first labours abroad; but if killed, which is often the case, the whole falls.

"It would appear that they are attacked by their own species; for in the place where I enticed them to build their hives I have found another queen dead, which I supposed to have come there to



## 3119. Larvæ of the Humble-bee in different stages of growth.

take possession, but to have been killed by the other queen and her offspring or labourers, who then were but few, being only two or three. They collect honey for store, but it is not of such extensive use as that of the common bee, although for a time answering the same purpose.

“A family is first begun by a simple female, not colonizing like the common bee, but she is afterwards assisted by her own offspring. She is very sparing of her labour, as also of that of those which she breeds; for I believe she never makes any provision to have her hive formed, but in making it often chooses some accidental place, as a mouse’s nest; and, although we find cells, yet these are not formed by her, but only by the maggot going into the chrysalis state; so that they appear to have been more busy than what they really are, for the whole of the cells are formed by the young maggot-bees; the queen’s whole labour is the formation of one cell of wax, bringing in farina, and laying eggs.

“It is to be remarked, that when I speak of *they* or *them*, I mean principally the labourers, although the queens may often be included, more especially at first, when she is beginning to form her colony, but never the males; for the variety in the actions of the Humble-bee, or the œconomy of the hive, belongs chiefly to the labourers.

“There are two periods where we may begin the history of the Humble-bee: viz. either in the autumn, when the female is copulating, just before she goes into winter-quarters; or in the beginning of summer, when she comes out to propagate, which last is the only time that can be called a beginning of their history, as the going into winter-quarters is only a simple act of a young queen bee, but which I shall begin with, because it leads to the coming forth in the spring. We shall find that the labourers are capable of breeding the same season, which produces a variety, as also an irregularity in the history of this Bee.

“*Of the Winter Habitation of the Queen.*—None but the young queens live through the winter: they leave their hives, and go into such places as instinct directs them to; but as those places are what may be called hiding-places, they are not easily detected. Not finding any on the taking down of old houses, nor in the removal of old brick walls, nor being informed by carpenters and bricklayers in the country that they ever observed any, I gave orders to my gardener to observe, whenever he took down any bank or dug up any old dry ground, to have an eye on this subject; and two Humble-bees having been found in the winter in the bank of a haw-haw, therefore I conceive a certain degree of moisture is necessary for their preservation. Their holes are, I believe, such as have been made by moles, and probably shrews and land-mice. It would appear they go to them at once, for we do not find Humble-bees flying about in autumn in search of such a place, as we find them in the beginning of summer in search of holes to form their hives in; a sleeping-place in the winter requiring less of everything than a place for the hive in the summer, although there are at this season fifty queens going into winter-quarters for one that comes out.

“According to the state of the weather in the autumn they go sooner or later into their winter-quarters; but if the autumn is cold and wet we find no Humble-bees flying about in the latter end of September. In the autumn of 1791 I found the Humble-bee but little abroad; and on the 28th of August, in digging a bank, we found a large Humble-bee about a foot beyond the surface of the declivity. It appeared at first dull and inactive, but when held in the hand and was warmed, it flew away. The weather had been showery, cold and windy for some time. I conclude that this bee had taken up its winter residence, for it could not have any home to go to. They remain in those places through

3120. A full-grown larva of a Humble-bee dissected, to show its capacious stomach.

the winter, but most probably not one in a hundred live through the winter, especially if the season is either severe or wet.

*“ Of the Time when they come forth.*—They continue in their winter-quarters till the weather becomes warm, which is in the spring; however, they sometimes come forth in good weather in the winter, but go to rest again most probably when the evening grows cold. About the beginning of January 1787 a Humble-bee was found in the grass very weak; it was brought in and put under a cover, but it died. On the 15th of the same month another was picked up, which was a large queen, and very lively; that was also put under a cover, but it slowly became weaker, and on the 20th of February it died; it had no fat in its belly. It is probable that those that came forth so early had not provided for themselves sufficiently in the autumn with a store of fat, and were obliged to come forth in hopes of food. In March I found a Humble-bee in a forcing-house, on the flower of a Persian lilac; it had come in at one of the windows, and was probably drawn there by the scent of the flowers. It was a large female or queen. It had a quantity of granulated fat in the abdomen, but not so oily as in the autumn. About the middle of April, when the apricot and peach blooms are come forth, then we find Humble-bees; but this depends on the season, for in the spring of 1790, after a very mild winter, as also a mild spring, when the apricot and peach blossoms were blown before the middle of March, we then had the Humble-bees flying abroad. About the latter end of March or beginning of April the Humble-bee is seen flying about. At this early season we find them on the blossoms of trees, &c., but only sucking for their immediate food, as they have not yet fixed on places for their hives. At about the beginning of May they fly about, and near to the ground, then lighting upon it, creeping upon the earth, and going into the holes of walls: these are in search of proper places for their summer residences for propagation. Such bees are all females, and of the largest size, but they do not seem to be at this time ready for propagation, for we seldom find any hives till May.

“ In their times of propagation they are not so regular as the common bee, for they cannot begin till the season will allow, having no provision in store. I found in the summer of 1791 some young Humble-bees abroad about the beginning of June, viz. small ones; and after this period we seldom find the first or large queens abroad, and when they do come out, I suspect that they have been disturbed or had their first hives destroyed, and that they are beginning anew.

*“ Of the Situation of their Hives.*—Their hives are found in various situations. They are in holes in the earth, especially in dry banks, in holes in walls, in thatch, in hay, in dry dung on the ground, at the roots of grass, in meadows, in trees, in an old nest of some bird, in a laurel-bush.

“ The same species will build either in grass or under ground, for I have found the queens in both, as also in dung. In whatever situation they choose, they are commonly led there by some other circumstance than simply situation, or else probably situation would be attended with less variety; but it seems to be more the materials of the nest that induce them, than this or that situation; for often, or almost always, when they can, they build their first or honeycomb in an old mouse's nest. What makes me suspect this, is the similarity of the materials between their hives and a mouse's nest; and a servant, who had orders from me to preserve every mouse's nest as well as Humble-bee hives when mowing, found a mouse's nest in the meadows, and upon opening the moss, dried grass, &c., he found five young naked mice, and with them a Humble-bee, which immediately flew away: this was it.



3121. Several of the cells of the Humble-bee, some of which are laid open, showing the contained pupa far advanced in development.

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the month of June. This bee most probably would have put up here if there had been no mice; or if they had been further advanced, she might have made them leave their quarters. I have found them in a rat's nest under ground\*.

"Upon this principle I made several experiments to entice them to certain places, in which I succeeded. For instance, on the 4th of June, I dug small cells or cavities in the ground, and bored a hole aslant into each of sufficient size for a bee to enter. Into these cavities I put some fine soft hay, and covered the cavities over with a flat stone or tile; I found in several of these Humble-bee hives, for I had only to raise the stone or tile and examine the hay. The first thing I observed in those where breeding was going on, was, that the hay where they had taken possession was perfectly dry, while the others were mouldy. A hole was to be observed either at the top or at one side, leading into the centre of the hay; the hay itself surrounding this hole was more regular, and as if turned round the hole; and this kind of regularity was carried down some way where the cell was formed for honey and breeding was begun. As this hay had been put in irregularly, the bee must have produced this irregularity, and, I imagine, by twisting herself round and round, so as to give the hay for a little space round her this circular form. By this contrivance I could at any time examine their progress; but they do not always confine themselves to places where the materials are collected for them; for I am of opinion they may have the power and disposition to collect materials for themselves.

"However, I am apt to think that they are directed to situations by some favourable circumstance; for in one that had built its nest in a laurel-bush, it had been led to this situation by the nest of a bird that had bred there the preceding summer; but the bird's nest was filled with moss, which was carried higher than the brim of the nest, and in the centre of which she (the bee) had deposited the materials and laid her eggs: but the question is, what brought the moss there? I can conceive it possible for this collection of moss to have been the labour of a mouse; and I am inclined to think that they (the bees) may not have the mode of bringing soft materials for the hive; for in some which I found under ground, where the straw had been either very scanty, or none at all, they had covered their work over with a sheet of substance like farina. However, they wish to cover their combs, &c., when exposed, with such soft materials as they can get; yet I do not imagine they bring it from any distance; for I believe they have not the power of carrying it; I rather conceive that they, as it were, scrape what is near them along to the hive; for I have put their comb on the ground with very short grass, and they have with their fore-legs scraped the grass under them, and in this manner they have gone backwards with it towards their hive and covered the hive at last. In the hives under

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\* "Although the Humble-bees would appear of all the bee-tribe to be the greatest slovens in their mode of propagation, yet most probably, like most slovens, they take more pains on the whole than many of the others. The regular and methodical way in which the common bee, the wasp, and the hornet begin their hives, appears to give but little trouble afterwards. There seems in the Humble-bee much more left to the instinctive principle, as they go on, either of the young or the mother, than in the above-mentioned species."



3122. Four cells of the Humble-bee ; one is entire, the others are laid open, so as to expose respectively the dorsal, the ventral, and the lateral

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ground I have observed that they form a covering for the whole. This covering is a very clumsy one, yet formed in some degree similar to the external covering of the wasp or hornet ; the external surface having a kind of oblique hollows passing upwards, but which do not pass through. However, this covering has several passages through it, through which the bees pass : it is composed, I imagine, of the farina, at least it has the same visible properties. I should suppose the intention of this is to keep out the wet that soaks through the ground ; for in such situations they have but little hay or moss. In some which I have moved from under ground and placed on a tile above ground, just at the opening of the passage by which they formerly entered, and covered it over with a garden-pot, I have observed them to have covered their comb or cell with a sheet of this substance, and I have found that they have removed it again. Their nest is always begun by a single female, which was one of the last year's brood, and is inhabited only one season. When the proper place is fixed upon, and the moss or hay (when there is such) is so prepared, as above described, in the centre of which she has formed a small space, or kind of cavity, then into this cavity she first makes a large cell or hollow ball, about the size of a nut (some larger), in which she deposits some honey, and often covers it entirely over. This globe is made of wax, and is, I believe, the only wax she forms. It melts by heat, but is commonly softer than the wax of the common bee ; nor is it so white, but appears of a dirty yellow, which I suspect is owing to its being mixed with farina, somewhat similar to what the common bee covers the chrysalis with. This honey would seem to serve the queen as a reservoir or magazine of food, when the weather is too bad for her to go abroad ; as also the first brood of bees, when just emerged from their pod, till they are able to go abroad, which pods now become reservoirs for honey for the first brood as they come from the chrysalis state. Having formed the hollow globe, she then begins to breed, and one would suppose to form her comb. She first brings in some farina on her hind-legs, similar to the common bees, but I think she gathers it from a greater variety of flowers, as it is composed of a greater variety of colours and consistence when on her legs. I imagine she mixes it with some juice, for it is more tenacious than simple farina, and is of a dirtier colour. She now deposits it in an irregular square mass a little way from the hollow ball. On this substance she deposits her eggs, one upon another, lying parallel, and then covers the eggs with the same kind of materials, forming a cavity in which they lie. There shall be half a dozen of these eggs or more in this little square. This becomes the basis on which all the future cases are formed. These eggs so deposited and covered over, hatch, and produce a maggot ; but in what time it is hatched after being laid I do not exactly know, but I have reason to believe their progress is pretty quick ; for in those which I have examined at different times, I found that such as had been laid on the day of examination had large maggots on that day fortnight. When hatched, they leave the soft shell of the egg in the cavity in which they are contained. This surrounding substance is the food of the maggot, as it is of the common bee, only that the present species feed themselves, while the labourers in the common bee feed the maggot. They feed upon the inner side of the surrounding mass, by which means they increase the cavity as they themselves grow ; and as they destroy the inside, the old one lays more on the out, so as to keep them always covered, which both incloses them and serves them for food ; and as they grow, this square mass becomes larger, commonly of an inch or more

surfaces of the contained pupæ, which are destined to be 'labourers'.

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square; so that the Humble-bee does not feed her young similar to the common bee, wasp and hornet.

" Their growth is pretty quick, for in about two weeks after hatching they are ready to go into the chrysalis state. Like the wasp, hornet and common bee, their excrement is left in the cell, and dries, which has often the appearance of bee-bread. When pretty large and ready to get into the chrysalis state, they have almost ate up their surrounding materials, making now a very imperfect covering for them, each maggot being of full size.

" They spin themselves a covering, which is at first attached to the inner surface and edges of the holes of this mass, which I have detected them in, in all the stages of the formation of the cell, which is similar to the food of other chrysalises; but as there is a series of them, and as they afterwards contain honey, they have, I believe, been considered as formed by the old bees for the purpose of breeding. Having now covered themselves over, I believe that the old one, or ones, remove that part of the mass which remained, for the cells become clean on the outside, excepting on the under surface, which forms a union between them, and, I believe, allows the cell afterwards to contain honey the better. This cell is a complete cavity, similar to all that make an entire pod; not similar to the bee, wasp or hornet, which only line their cell formed by the labourers, and do not line the bottom. These cells form a very regular cylinder, rounded off at each end, and are very strong and thick in their coat. They are united at their bottoms to each other with a brown substance, which, indeed, covers the whole bottom of the cell: in this cell they cast their last maggot-coat, and change into the chrysalis state, placing their head uppermost, and in about eight days they are ready to come forth. Before the bee comes forth from the pod, the queen deposits on the upper surface and towards one edge of this square mass of pods, a mass of farina, in which she lays some eggs, which she covers with the same materials as before. These cells are placed at the beginning parallel to each other pretty regularly, forming the first batch of pods, and which are small, but they become more and more irregular as the formation of the mass of cells proceeds. When the chrysalis has formed all the parts belonging to the bee state, they emerge from this cell or pod, throwing off, or creeping out of their chrysalis coat, which covered them in this state. It requires a great deal of labour to get out of the cell; they are obliged to tear and destroy the upper end with their lateral teeth or pincers: we can hear them at work before they have made an opening; and when their heads have got through, but not their body, they work at the edges to enlarge it. As the maggot is constantly inclosed in this mass of farina, it is not so easy to say when it changes into the chrysalis state, but now as it forms a well-formed cell for itself its progress is more detectable. In the common bee, wasp, &c. the change is known by their covering the mouths of their cells; but in the Humble-bee they inclose or line the cell of farina. These cells, from whence the young bees have emerged, I have observed become a deposit for honey for the whole hive in wet weather, and for the young bees that are bred in future. As the cells are to contain honey, they are strong and durable in their substance; but that it might retain fluid honey, it is lined with a substance; and to render the honey more secure, they often cover over the mouths of their cells; likewise deepen many by raising their edges with the same kind of substance that forms the first cell or globe.



### 3123. A series of the cells of a Humble-bee, showing the progressive deve-

“ When they come from the cell their hair is wet, but it soon dries. Those parts which are (afterwards) of a dun or brown colour, are at this time white, but in a short time they become brown. For some time the young bee seems incapable of flying, and is provided by the mother with honey, which they begin to lap as soon as they emerge from the cell: indeed I have put honey before them when only the head was through, and they have lapped it up: but they are soon able to assist the mother in collecting materials for the further support of the increasing family. The dab of farina which she placed on one of the edges of the square mass of chrysalises into which she deposited her eggs, is kept increasing as the maggot grows; going through the same process as before, forming another batch of cells on this edge, which does not accord with it in regularity in any way.

“ The queen is now assisted by this her first offspring of labourers, and they now assist in bringing in honey to fill their own cells from whence they came; also bringing in farina for a new or third offspring, which is placed upon another edge at the top; or the top of one of the chrysalis cells into which she deposits her eggs, which goes through all the above-described processes. While the chrysalis is completing in the second batch, they are placing their dabs of farina on them for a fourth; and so they go on increasing their number of batches, as also the cells in the same proportion.

“ This mode of increase of cells by different batches obliges them to be very irregular, for although each batch has a kind of corresponding regularity respecting itself, yet it has none respecting that on which it is placed; so that by the time that they have done breeding, the whole makes a very irregular mass of cells, the first cells being undermost; and as new ones become completed by the successive births, they are neglected, and, from their situation, they are allowed to moulder away, and often they become the nidus for the eggs of flies.

“ To ascertain with accuracy the circumstances attending their increase, I continued the before-mentioned mode of enticing them to proper places, from which I had an opportunity of examining a great number of hives at different periods from each other, so as to bring out what was going on.

“ When we observe the progress of the hives only, we find that the first and second tier of chrysalises in their cell are very small, being those of labourers; that the second or third tier are larger, which are principally males; and that the succeeding and upper tier are composed of much larger chrysalises, and which are the young queens. The female labourers are of very different sizes; the males are all nearly of the same size, as has been already observed. After the queen has made some progress in the hive, we find two kinds of females, with males, therefore there may be said to be in each hive three different kinds of bees, having three periods for their production and lives. The small females and the males are produced first, and the queens last. In the month of June we find nothing but small bees, but in July, especially about the latter end, we find the large chrysalis-pods, and also young queens.

“ I before observed that the hay, moss, &c. placed to attract the Humble-bees was dryer than the hay in similar situations without the bees; this is owing to a greater degree of heat in this inhabited place than the heat of the part abstracted from them. I found the difference near twenty degrees. We may observe, that no insects inhabit such nests; the place shall be surrounded with ants, grubs, &c., but none go among the hay or cells; but the moment such a nest is forsaken, the honey, maggots, or chrysalises, are immediately devoured.

“ *Of the Food of the Maggot Humble-bee.*—It must have appeared, from what has been already



lopment of the pupa to the assumption (in the upper cell) of the

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said respecting the progress of propagation, that the farina of plants, which they bring in on their legs, is the food of the maggot, for I have found it in the stomach of the maggot; but it often seems to differ from that on the legs in consistence, although I have found it in some the same to appearance, being very different in different bees as they are collecting it. It does not dry as the farina does, but keeps nearly of the same moisture, similar to the bee-bread. Probably they mix it with some juice that does not dry readily, or, to prevent its drying, it is possible they may mix it with the juice of some other plants which does not dry; for instance, the inspissated juices of the leek and onion do not dry.

“ I took some of the materials that inclosed the maggot, and some of the matter from a Humble-bee’s leg, and put them on a piece of clean white paper, and burnt them to see if they melted, and all smelt alike: the materials from the Humble-bee maggot melted a little, and burnt, and gave a pretty sensible smell; that from the leg of the Humble-bee much the same, only it did not smell so strong; but their scent were the same in quality although not in quantity. This substance is both their food and their covering.

“ To see if there could be extracted anything like wax, or even oil, I boiled a very large hive, and got a very small quantity of a substance that floated on the water; and when I (had) dried it, it hardly melted, although it did in a small degree, and burnt pretty clear, by leaving a tolerably large cinder, but I conceived it had (wax).

“ In one of my places (which) I made to entice a female to begin her colony, after having formed her hive and bred several small bees, I took from them the whole comb to see if they would set about a new hive, which they did; but on examining it the 12th of August, I was astonished to find there were no young females, only the large queen and labourers, nor were there any large cells containing large bees in the chrysalis state. I examined the hive again on the 8th of September, when I found only one queen, with several labourers and males. All the chrysalises were come forth, and I observed one cell which I conceived had belonged to a young queen. Why she did not breed queens as usual I cannot imagine. The queen was very weak, not able to fly, and died the day after she was taken, which would appear to be much sooner than the queens of former hives died; but when there are many young queens, it is not so easy to ascertain when the old queen dies; and probably this circumstance explains it, and she had lived her natural life. In June I took away from a hive, where there were a good many bees, the last-formed chrysalis, which either contained males or queens, to see if the future were to be all queens, but they appeared to (have) become lazy.

“ To ascertain whether any of the labourers or young queens laid eggs, I took the whole hive of bees, and examined their oviducts to see what state they were in, and I found but one queen whose oviducts were full of eggs, which made me conclude she was the mother of the whole; all the other queens having small oviducts and empty, or at least no eggs fit for laying; and I found what I did not expect, viz. that some of the labourers, even the smallest, had their oviducts full of eggs, and others with none. This observation led to the following experiments. I removed the queen after she had bred some labourers and males, and also every maggot and egg that lay on the comb: this being done, I found in about a week after dabs of farina with eggs and maggots: these I allowed to remain till about the 8th of August, and upon examination I only found six females and seven males, one of which had just come forth, which males I think were smaller than common. There were no queens bred by the labourers, and I observed that they did not continue the hive equal to those whose queens

imago state. These pupæ are of larger size, and are destined to be "queens".

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were left in the hive. There always became fewer and fewer of them till the whole was deserted, probably about the time the queen would have begun to breed young queens. This experiment I have repeated, and with the same success.

"*Of their Copulation.*—On the first of August, 1789, having before taken a hive with the whole bees and put them under a large glass shade, they went out and into their hives; but one day I saw a large bee on one of the sides of the shade, and another, as it were, standing on its tail with its four feet on the back of the other. Suspecting they were in the act of copulation, I caught them both, and immediately immersed them into spirits. The male did not let go his hold, and they both died in this position. I found the two holders fast on the sides of the beginning of the vagina. The sting of the female was, as it were, projecting between the two: this was at a period when breeding was over; for in this hive there was neither maggots nor eggs, and only a few chrysalises, so that copulation could answer no good purpose for this season, therefore only fitting them for the next. As we never find them copulating abroad like many other insects, it is reasonable to suppose that they copulate at home, and more especially, as they will by this means keep to their own family in their propagation.

"About the latter end of August the Humble-bees are becoming indolent or inactive, more especially the males. This indolence increases through the month of September, and some way in October, if the weather is tolerable, but by the middle of October there are hardly any to be seen. The males are now many more in number than the labourers, about eight or ten to one. On the 29th of August I caught thirty bees, and only one of them was a labourer. The males about this period get into large flowers, probably for food, such as the flower of the hollyhock, and not finding much, and the weather becoming cold, and now hardly any home to go to, they become benumbed and die.

"To see what would become of them, if I were to take better care of them than what the season now allows, I had caught for me, through the month of October, all the Humble-bees that could be found: I put them under a large glass, with honey for them to feed upon, which they did, but they all died in the course of some days after being confined. The intention was to see what lived through the winter and what not. It was in these trials I observed the disproportion between males and females: they both died equally fast; and of the females, whether large (which I supposed to have been the last year's) or small, they died equally soon; most of them died with the proboscis erected or elongated.

"*Of the Progress of Breeding.*—The progress of breeding appears to be in this manner: the first is the female bee of the last year's brood, which has lain dormant through the winter. She begins the hive; and the first brood are the small bees or labourers, which assist the mother in the labours of the family, bringing in farina for the future maggots, and also probably honey, to fill the pods or cells from whence they come; and, towards the latter end of the season, they even lay eggs. Some males are in the nest to impregnate the breeding labourers, and then the young queens are bred. How far labourers are continued to be bred along with the males and young queens I do not yet know, but I believe some are, for I have found small pods or chrysalises along with the large. I have reason to suppose that the males give no assistance to the females in collecting either the farina or honey. I



[The following twenty preparations illustrate the generative œconomy of the Hive-bee, *Apis Mellifica*\*.]

have never been able to detect a male with farina on its legs, although I have examined many hundreds. Nor do I imagine that what are to be the next year's queens give any assistance in the year they are themselves bred; indeed they are hardly bred early enough to breed much that season."

*Hunterian Manuscript.*

\* They include the subjects of the following account of the honeycomb and metamorphosis of the Bee, given by Hunter:—

"The cells, or rather the congeries of cells, which compose the comb, may be said to form perpendicular plates, or partitions, which extend from top to bottom of the cavity in which they build them, and from side to side. They always begin at the top, or roof of the vault, in which they build, and work downwards; but if the upper part of this vault, to which their combs are fixed, is removed, and a dome is put over, they begin at the upper edge of the old comb, and work up into the new cavity at the top. They generally may be guided as to the direction of their new plates of comb, by forming ridges at top, to which they begin to attach their comb. In a long hive, if these ridges are longitudinal, their plates of comb will be longitudinal; if placed transverse, so will be the plates; and if oblique, the plates of comb will be oblique. Each plate consists of a double set of cells, whose bottoms form the partition between each set. The plates themselves are not very regularly arranged, not forming a regular plane where they might have done so; but are often adapted to the situation, or shape of the cavity in which they are built. The bees do not endeavour to shape their cavity to their work, as the wasps do, nor are the cells of equal depths, also fitting them to their situation; but as the breeding cells must all be of a given depth, they reserve a sufficient number for breeding in, and they put the honey into the others, as also into the shallow ones. The attachment of the comb round the cavity is not continued, but interrupted, so as to form passages; there are also passages in the middle of the plates, especially if there be a cross stick to support the comb; these allow of bees to go across from plate to plate. The substance which they use for attaching their combs to surrounding parts is not the same as the common wax; it is softer and tougher, a good deal like the substance with which they cover in their chrysalis, or the humble bee surrounds her eggs. It is probably a mixture of wax with farina. The cells are placed nearly horizontally, but not exactly so; the mouth raised a little, which probably may be to retain the honey the better; however, this rule is not strictly observed, for often they are horizontal, and towards the lower edge of a plane of comb they are often declining. The first combs that a hive forms are the smallest, and much neater than the last, or lowermost. Their sides, or partitions between cell and cell, are much thinner, and the hexagon is much more perfect. The wax is purer, being probably little else but wax, and it is more brittle. The lower combs are considerably larger, and contain much more wax, or perhaps, more properly, more materials; and the cells are at such distances as to allow them to be of a round figure: the wax is softer, and there is something mixed with it. I have observed that the cells are not all of equal size, some being a degree larger than the others; and that the small are the first formed, and of course at the upper part, where the bees begin, and the larger are nearer the lower part of the comb, or last made: however, in hives of particular construction, where the bees may begin to work at one end, and can work both down, and towards the other end, we often find the



3124. A fertile female or queen Bee (*Apis mellifica*, LINN.), with the ventral parietes of the abdomen removed to show the alimentary canal and ovaria.

larger cells both on the lower part of the combs, and also at the opposite end. These are formed for the males to be bred in; and in the hornets' and wasps' combs, there are larger cells for the queens to be bred in: these are also formed in the lower tier, and the last formed.

"The first comb made in a hive is all of one colour, viz. almost white; but it is not so white towards the end of the season, having then more of a yellow cast.

"*Of the Royal Cell.*—There is a cell, which is called the Royal Cell, often three or four of them, sometimes more; I have seen eleven, and even thirteen in the same hive; commonly they are placed on the edge of one or more of the combs, but often on the side of a comb; however, not in the centre, along with the other cells, like a large one placed among the others, but often against the mouths of the cells, and projecting out beyond the common surface of the comb; but most of them are formed from the edge of the comb, which terminates in one of these cells. The royal cell is much wider than the others, but seldom so deep: its mouth is round, and appears to be the largest half of an oval in depth, and is declining downwards, instead of being horizontal or lateral. The materials of which it is composed are softer than common wax, rather like the last mentioned, or those of which the lower edge of the plate of comb is made, or with which the bees cover the chrysalis: they have very little wax in their composition, not one third; the rest I conceive to be farina.

"This is supposed to be the cell in which the queen is bred, but I have reason to believe that this is only imagination: for, first, it is too large, and, moreover, seldom so deep as the large cells in which the males are bred; whereas, if proportioned to the length of the queen, it ought to be deeper, for length of body is her greatest difference. In the second place, its mouth is placed downward; and in the third place, it is never lined with the silken covering of the chrysalis, similar to the cells of the males and labourers; nor do we find excrement at the bottom of it. The number of these cells is very different, in different hives. I think I have seen hives without any, and I have seen them with eleven or twelve, sometimes more. I have examined them at all times through the summer, but never found any alteration in them.

"The comb seems at first to be formed for propagation, and the reception of honey to be only a secondary use; for if the bees lose their queen, they make no combs; and the wasp, hornet, &c. make combs, although they collect no honey; and the humble bee collects honey, and deposits it in cells she never made.

"I shall not consider the bee as an excellent mathematician, capable of making exact forms, and having reasoned upon the best shape of the cell for capacity, so that the greatest number might be put into the smallest space (for the hornet and the wasp are much more correct, although not seemingly under the same necessity, as they collect nothing to occupy their cells); because, although the bee is pretty perfect in these respects, yet it is very incorrect in others, in the formation of the comb: nor shall I consider these animals as forming comb of certain shape and size, from mere mechanical necessity, as from working round themselves; for such a mould would not form cells of different sizes, much less could wasps be guided by the same principle, as their cells are of very different sizes,

3125. A portion of honeycomb, showing the breeding-cells and the larvæ in all stages of development, from the ovum cemented to the bottom of the open and incomplete cell, to the commencement of the pupa state, when the cell is closed.

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and the first by much too small for the queen wasp to have worked round herself: but I shall consider the whole as an instinctive principle, in which the animal has no power of variation, or choice, but such as arises from what may be called external necessity. The cell has in common six sides, but this is most correct in those first formed; and their bottom is commonly composed of those sides, or planes, two of the sides making one; and they generally fall in between the bottoms of three cells of the opposite side; but this is not regular, it is only to be found where there is no external interruption.

“ I have already observed, that the last-formed cells in the season are not so well made: that their partitions are thicker, and more of a yellow colour: this arises, I imagine, from the wax being less pure, having more alloy in it; and therefore, not being so strong, more of it is required. The bees would appear to reserve many of their cells for honey, and those are mostly at the upper part. In old hives, of several years standing, I have found the upper part of the comb free from the consequences of having bred, such as the silk lining, and the excrement of the maggots at the bottom; while the lower part, for probably more than one half of the plane of cells, showed strong marks of having contained many broods of young bees. In such the lining of silk is thick at the sides, composed of many laminæ; and in many, the bottom is half filled up with excrement; and I observed at such parts, the comb was thickest at its mouth, which inclines me to think, that when a cell becomes shallow, by the bottom being in some degree filled up, the bees then add to its mouth. Such also they seem to reserve principally for the bee-bread; so that to lay up a greater store of honey is an object to them.

“ *Of the Laying of Eggs.*—As soon as a few combs are formed, the female bee begins laying of eggs. As far as I have been able to observe, the queen is the only bee that propagates, although it is asserted that the labourers do. Her first eggs in the season are those which produce labourers; then the males, and probably the queen; this is the progress in the wasp, hornet, humble-bee, &c. However, it is asserted by Riem, that when a hive is deprived of a queen, labourers lay eggs; also, that at this time, some honey and farina are brought in, as store for a wet day. The eggs are laid at the bottom of the cell, and we find them there before the cells are half completed, so that propagation begins early and goes on along with the formation of the other cells. The egg is attached at one end to the bottom of the cell, sometimes standing perpendicularly, often obliquely; it has a glutinous, or slimy covering, which makes it stick to any thing it touches. It would appear that there was a period or periods for laying eggs; for I have observed in a new swarm, that the great business of laying eggs did not last above a fortnight; although the hive was not half filled with comb, it began to slacken. Probably that end of the egg which is first protruded, is that which sticks to the bottom of the cell; and probably the tail of the maggot is formed at that end: when they move the egg, how they make it stick again, I do not know. I have just observed, that they often move the egg out of a cell, to some other, we may suppose; why they do this, I cannot say; whether it is because we have been exposing this part, is not easily determined. In those new-formed combs, as also in many not half finished, we find the substance called bee-bread, and some of it is covered over with wax; which



3126. A similar preparation. The larva at first lies coiled up at the bottom of the cell, but, as its growth proceeds, it changes its position, and the axis of its body becomes parallel to that of the cell, which it finally fills, before it is closed up to undergo the metamorphosis from the pupa to the imago state.

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will be considered further. By the time they have worked above half way down the hive, with the comb, they are beginning to form the larger cells, and by this time the first broods are hatched, which were small, or labourers; and now they begin to breed males, and probably a queen, for a new swarm; because the males are now bred to impregnate the young queen for the present summer, as also for the next year. This progress in breeding is the same with that of the wasp, hornet, and humble-bee\*. Although *this account* is commonly allowed, yet writers on this subject have supposed another mode of producing a queen, when the hive is in possession of maggots, and deprived of their queen.

“What may be called the complete process of the egg, namely, from the time of laying to the birth of the bee, (that is, the time of hatching,) the life of the maggot, and the life of the chrysalis, is, I believe, shorter than in most insects. It is not easy to fix the time when the eggs hatch: I have been led to imagine it was in five days. When they hatch, we find the young maggot lying coiled up in the bottom of the cell, in some degree surrounded with a transparent fluid. In many of the cells, where the eggs have just hatched, we find the skin standing in its place, either not yet removed, or not pressed down by the maggot. There is now an additional employment for the labourers, namely, the feeding and nursing the young maggots. We may suppose the queen has nothing to do with this, as there are at all times labourers enough in the hive for such purposes, especially too, as she never does bring the materials, as every other of the tribe is obliged to do at first; therefore she seems to be a queen by hereditary, or rather, by natural right, while the humble-bee, wasp, hornet, &c. seem rather to work themselves into royalty, or mistresses of the community. The bees are readily detected feeding the young maggot; and indeed a young maggot might easily be brought up, by any person who would be attentive to feed it. They open their two lateral pincers to receive the food, and swallow it. As they grow, they cast their coats, or cuticles; but how often they throw their coats, while in the maggot state, I do not know. I observed that they often removed their eggs; I also find they very often shift the maggot into another cell, even when very large. The maggots grow larger and larger till they nearly fill the cell; and by this time they require no more food, and are ready to be inclosed for the chrysalis state: how this period is discovered I do not know, for in every other insect, as far as I am acquainted, it is an operation of the maggot, or caterpillar itself; but in the common bee, it is an operation of the perfect animal; probably it arises from the maggot refusing food.

“The time between their being hatched and their being inclosed is, I believe, four days; at least, from repeated observations, it comes nearly to that time: when ready for the chrysalis state, the bees

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\* Reaumur on Bees, says, that the drone eggs, when laid in small cells, produce drones; and Wilhelmi says, that it is the labourers only that lay drone eggs. Mr. Riem says, that queens are never reared in any but royal cells, although males sometimes in common cells; and workers in old queen cells, but never in those recently made.



3127. A portion of honeycomb, of which the cells are all destined for the purposes of propagation, and show the larvæ further advanced.
3128. A portion of honeycomb, with pupæ of the labourers or infertile females in the breeding-cells.
3129. A portion of honeycomb, with pupæ of the drones or males in the breeding-cells.
3130. A similar specimen, in many of the cells of which the pupæ have passed into the imago state.
3131. A portion of honeycomb of a darker colour, and probably, therefore, constructed at a later period of the year.
3132. A similar specimen.

cover over the mouth of the cell, with a substance of a light brown colour, much in the same manner that they cover the honey, excepting that, in the present instance, the covering is convex externally, and appears not to be entirely wax, but a mixture of wax and farina. The maggot is now perfectly inclosed, and it begins to line the cell and covering of the mouth above-mentioned, with a silk it spins out similar to the silk-worm, and which makes a kind of pod for the chrysalis. Bonnet observed, that, in one instance, the cell was too short for the chrysalis, and it broke its covering, and formed its pod higher, or more convex than common: this I can conceive possible; we often see it in the wasp. Having completed this lining, they cast off, or rather shove off, from the head backwards, the last maggot coat, which is deposited at the bottom of the cell, and then they become chrysalises.

“*Of the Chrysalis State.*—In this state they are forming themselves for a new life: they are either entirely new built, or wonderfully changed, for there is not the smallest vestige of the old form remaining; yet it must be the same materials, for now nothing is taken in. How far this change is only the old parts new modelled, or gradually altering their form, is not easily determined. To bring about the change, many parts must be removed, out of which the new ones are probably formed. As bees are not different in this state from the common flying insects in general, I shall not pursue the subject of their changes further; although it makes a very material part in the natural history of insects.

“When the chrysalis is formed into the complete bee, it then destroys the covering of its cell, and comes forth. The time it continues in this state is easier ascertained than either in that of the egg, or the maggot; for the bees cannot move the chrysalis, as they do the two others. In one instance it was thirteen days and twelve hours exactly; so that an egg in hatching being five days, the age of the maggot being four days, and the chrysalis continuing thirteen and a half, the whole makes twenty-two days and a half: but how far this is accurate, I will not pretend to say. I found that the chrysalis of a male was fourteen days, but this was probably accidental. When they first come out, they are of a greyish colour, but soon turn brown.”—*Hunter, Observations on Bees, Philos. Trans.*, 1792, pp. 148–158.

- 3133. A portion of a single layer of breeding-cells, showing the form of the bottom of the cells which were in apposition to the corresponding extremities of the cells of the opposite layer.
- 3134. A longitudinal section of a portion of a double tier of old cells, showing the number of exuvial coats of the larvæ with which they have been successively lined.
- 3135. Three similar old breeding-cells, in longitudinal section.
- 3136. Two old breeding-cells.
- 3137. A similar preparation, with the several layers of membrane, formed by the exuvial coats of successive broods of larvæ, reflected downwards.
- 3138. A portion of honey-comb, the cells of which are destined for the reception of honey.
- 3138 A. A portion of honey-comb, showing the commencement of the formation of a double tier of honey-cells. *Presented by Sir Everard Home, Bart.*
- 3139. A larva and pupa of the Hive-bee.
- 3140. A series of pupæ in different stages of development.
- 3141. Two workers, or infertile females, in the imago state.
- 3142. A fertile female, or queen Bee, in the imago state.
- 3143. Ova and larvæ of an Ant (*Formica*, LINN.).
- 3144. The pupa and puparium of an Ant.
- 3145. An Ant at the period of transition from the pupa to the imago state.
- 3145 A. The perfect male of the Fighting Termite (*Termes bellicosus*, SMEATHMAN). There is but one individual in each colony of Termites, to which the office of impregnating the countless ova of the female is assigned, and it is hence termed the "king." *Leverian Museum.*
- 3146. The fertile female of the *Termes bellicosus*, with the abdominal segment of the body expanded to about one third the size which it attains when the ovarian tubes have acquired their full development. She is the only fertile female, and mother of the colony; she is confined with the male in a royal chamber, and is called the "queen."

- 3146 A. The queen Termite (*Termes bellicosus*), with the development of the ovarian tubes further advanced. *Leverian Museum.*
3147. The queen Termite (*Termes bellicosus*), at the full period of the development of the ovarian tubes: the greater part of this astonishing apparatus is displayed by the removal of the ventral parietes of the enormous abdominal cavity. The alimentary canal is transversely divided, and a bristle is placed in the rectum. The short terminal oviducts are separated from the ovarian apparatus and are reflected downwards. The ovaries are two in number, consisting of many hundred ovarian tubules, each containing innumerable eggs.
3148. A portion or lobe of the ovarian apparatus of the queen Termite, showing the close aggregation and wavy convergence of the ovarian tubules.
3149. A longitudinal section of a lobe of the ovarian apparatus of the queen Termite, exhibiting the central wavy branch of the oviduct receiving the open terminations of the cæcal ovarian tubules of that lobe.
3150. Dissected portions of the ovarium of the queen Termite.
- 3150 A. A series of the infertile individuals of the *Termes bellicosus*, exhibiting that modification of the imago state to which the term "labourer" is given. Upon these devolves the office of erecting and repairing the buildings, collecting provision, attending upon the queen, conveying the eggs, when laid, to the cells called "nurseries," and feeding the young larvæ till they are old enough to take care of themselves. *Leverian Museum.*
- 3150 B. A series of the infertile individuals of the *Termes bellicosus*, in which the head is relatively longer and larger, being expanded to give space to the muscles which work the more powerfully developed horny subulate mandibles: these are called "soldiers." Their office is to defend the nest when assailed by enemies. *Leverian Museum.*
- 3150 c. A fertile female, or "queen," of the *Termes Mordax* (SMEATH.), exhibiting nearly the full expansion of the abdomen and development of the contained ovarian apparatus in that species. *Leverian Museum.*



3151. A queen of the *Termes Mordax*, with the expanded abdomen laid open, to show the two immense lobes of the ovarium *in situ*, and their short terminal oviducts : a bristle is inserted in the rectum.
- 3151 A. A series of the infertile individuals of the *Termes Mordax*, exhibiting that modification of the imago state to which the term "labourer" is applied. *Leverian Museum.*
- 3151 B. A series of the infertile individuals of the *Termes Mordax*, exhibiting the modification of the cephalic segment and its associated powers and habits, from which they have obtained the name of "soldiers." *Leverian Museum.*
- 3151 C. A few fertile individuals of the Tree Termite (*Termes Arborum*, SMEATH.), in the imago state, when they are provided with wings : with these they emerge from their clay-built nests by myriads, but after one day's flight the wings drop off, and few escape the numerous enemies that take advantage of their now helpless condition. *Leverian Museum.*
- 3151 D. A series of the infertile individuals of the *Termes Arborum*, exhibiting that modification of the imago state to which the term "labourer" is applied. *Leverian Museum.*
- 3151 E. A series of the infertile individuals of the *Termes Arborum*, called "soldiers." *Leverian Museum.*
3152. A leaf of a willow, with many oval excrescences produced by the ova and larvæ of some insect (*Cynips*?).
3153. The artificial larval case of the Caddis-fly (*Phryganea grandis*, LATR.). It is a cylindrical tube, formed of small grains of sand, cemented together by a secretion of the larva, analogous to silk, and strengthened by longitudinal pieces of stick. The tube is open at both ends for the entry of water ; and the larva, which lives under water, always transports its domicile along with it.
3154. Several of the artificial larval cases of the Caddis-fly (*Phryganea*).
3155. A female Cicada, preserved to show the anal instruments by which the perforations in dry and hard wood, destined for the reception of her eggs,

are made. These appendages resemble a double auger, the sides of which are moved alternately and parallel to each other, until the hole is bored of the requisite depth.

3156. The larva of a Cicada (*Cicada Australis*, DON.). It differs from the perfect insect, chiefly in the absence of wings, and the forcipated structure of the anterior pair of legs.

3157. The exuvial integument of the larva of the same species of Cicada.

3158. The pupa of the same species of Cicada at near the completion of that stage, exhibiting the soft rudimental condition of the wings of the imago.

3159. The perfect insect or imago of the same species of Cicada.

3159 A. An exotic species of Land-bug (*Pentatoma*, OLIV.), with the dorsal parietes of the abdomen removed to show the short, wide and simple ovarian tubes, and the few and large ova developed therein.

*Prepared by Mr. Owen.*

3160. A Water-bug (*Belostoma grandis*, FABR.), with one half of the ventral parietes of the abdomen removed to show the ovarian tubes and ova *in situ*.

3161. The pupa of the *Belostoma grandis*, exhibiting the commencing development of the wings, which are the characteristic organs of the imago.

3162. The Cakerlac (*Blatta Americana*, LINN.), with the ventral parietes of the abdomen removed, so as to display the digestive and generative organs *in situ*. The single straight and wide oviduct, in which the nidamental covering of the ova is prepared and applied, is principally shown.

3163. A common Cockroach (*Blatta orientalis*, LATR.), with the ova and their nidamental case extruded but still adhering to the anal segment.

3163 A. Three of the nidamental cases of the Cockroach, attached to a piece of wood.

*Presented by Dr. Leach.*

3164. A Cockroach, just entering upon the imago state, with the wings soft, and the whole body of a dull white colour.

3165. A Locust (*Pterophylla myrtifolia*, KIRBY), with the ventral and sinistral parietes of the abdomen removed to show the large flattened oblong ova in the wide oviduct of the left side: the principal convolutions of the intestinal canal are likewise displayed.
3166. A Locust (*Acrida viridissima*, KIRBY), with the spermatheca, and one of the wide oviducts full of ova, reflected downwards.  
The anal segment is produced into a long, narrow and straight ensate ovipositor, consisting of two flattened horny plates, which are thrust into the earth, and then separated sufficiently to convey the ova into the hole thus prepared for them.
3167. A Locust (*Acrida*, KIRBY), with the right side of the thoracic and abdominal cavities removed, exposing the whole alimentary canal and the right oviduct full of ova. The ovipositor is long, and slightly bent or sabre-shaped, in this species.
3168. The ovaria, oviducts, spermatheca, and one of the valves of the ovipositor of a large species of Locust (*Acrida*, KIRBY).
3169. A female Mantis (*Mantis religiosa*, LINN.), dissected to show the alimentary canal and generative apparatus *in situ*: the ovarian tubes are numerous, short and simple; the ova are at an early period of their development.
3170. The alimentary canal, ovaria and oviducts of a Mantis: the ova are here fully developed. One of the complex branched ovaria is *in situ*; the other has been detached and unravelled.
3171. The camerated nidamentum of a Mantis: a section is detached from one side to show the series of large and small cells in which the ova were developed.
3172. The alimentary canal, and one of the oviducts, and ovarian system of tubes of the Spectre-insect (*Phasma Gigas*, LATR.). Each of the ovarian tubes contains a single large elliptical ovum.
3173. Three ova of the Chigoe (*Pulex penetrans*, LINN.), in different stages of development.



### SERIES X. In Arachnidans.

3174. A Spider (*Aranea*, LINN.), with its silken cocoon and brood; most of the young spiders have been excluded from the ovum, and a few only remain in the cocoon: the rest lie at the bottom of the bottle.
3175. Half of the cocoon of a Spider, together with the ova which it contained.
3176. Ova of a Spider.
3177. The cocoon of a Spider, bisected, to show the contained brood.
3178. A similar specimen.
3179. The cocoon of a Spider, attached by short filaments to another body.
3180. The cocoon of a Spider.
- 3180 A. A Bird-spider (*Mygale avicularia*, LATR.), with its cocoon and brood.  
Mus. Langstaff.
3181. Three ova of a Scorpion (*Buthus africanus*, LEACH). They present a subspherical form, and the chorion is sufficiently transparent to permit the inclosed embryo to be distinctly seen.
3182. Three new-born young of the Scorpion; the ova of this species are hatched within the sacculated oviduct of the parent.

### SERIES XI. In Crustaceans.

3183. A female parasitic isopodous Crustacean (*Cymothoë Lichtenaultii*, LEACH), with the abdominal plates partly cut away to show the marsupial cavity: some of the ova still remain therein, but the greater part have been displaced and lie at the bottom of the bottle.
3184. A Shrimp (*Crangon*, LEACH), with several ova, attached to the sub-abdominal ciliated plates.
3185. A Craw-fish (*Astacus fluviatilis*, FABR.), with the ova attached to the sub-abdominal ciliated appendages.

3186. The left moiety of a longitudinally bisected Craw-fish, showing the collapsed and empty state of the ovarium and oviduct, and the excluded ova, attached to the sub-abdominal ciliated plates.
3187. A Craw-fish, exhibiting the sub-abdominal ciliated plates, from which the ova have been recently detached, by the exclusion of the young.
3188. A Lobster (*Astacus marinus*, FABR.), with the two slender and collapsed ovaria displayed *in situ*, and the oviduct traced on each side to its termination at the basal joint of the third pair of legs: bristles are inserted into the two vulvæ. The ova have been recently excluded and are lodged in the marsupial interspaces of the broad ciliary plates to which they are attached by the short and slender nidamental filaments.
3189. The excluded ova of a Lobster, in a more advanced stage of development.
3190. A female Hermit-crab (*Pagurus streblonyx*, LEACH), with the ova pendent in groups of oblong bunches to the ciliated appendages which project from the side of the soft post-abdominal segment.
3191. A female Crab (*Cancer*, LINN.), with the excluded ova situated in a large mass between the short inflected tail or post-abdomen and the plastron.
3192. The post-abdominal or caudal segment of a female Crab (*Maia Squinado*, LAM.), exhibiting the ciliated appendages and attached ova.
3193. A Crab (*Xantho*, LEACH), exhibiting the sub-abdominal ovarian sac.
3194. A Crab (*Grapsus*, LAM.), with the ova excluded from the oviducts, and collected beneath the broad short tail, characteristic of the female sex.
3195. Ova of a Crab, dried, and attached to the side of the bottle.

## SERIES XII. In Fishes.

3196. The trunk of a Lampern (*Petromyzon fluviatilis*, LINN.), with the ventral parietes of the abdomen removed to show the ovaria and intestinal canal *in situ*.

(See the description of this simple form of the female generative organs, *Physiological Catalogue*, vol. iv. p. 129, Nos. 2658 and 2659.)

3197. A similar preparation ; a bristle is inserted into the rectum.
3198. The ovaria removed from the abdomen of a Lampern.
3199. The ovaria and kidneys of the Lamprey (*Petromyzon marinus*, LINN.), showing the ova ripe for the dehiscence of the ovisacs : it is thus that they escape from the ovarian lobes into the abdominal cavity, whence they are expelled by the peritoneal outlets.
3200. A section of a Lamprey, dissected to show the ovarium, after the dehiscence of the ovisacs. The alimentary canal is removed, except the termination of the rectum, which is laid open ; bristles are inserted into the ureters, and into one of the peritoneal canals ; the preparation is minutely injected.
3201. A section of a Lamprey, exhibiting a portion of the discharged ovarium, and of the kidneys and ureters *in situ* : the latter tubes are distended with mercury.
3202. A section of an Eel (*Anguilla latirostris*, YARRELL), showing the posterior extremities of the ovaria, and the termination of the rectum, and the peritoneal outlets through each of which a bristle is passed. The ovaria extend some way beyond the anus, in the fleshy substance of the tail : the ova escape, as in the Lamprey, by dehiscence of the ovisacs, into the abdominal cavity, and are thence extruded by muscular pressure from the peritoneal outlets\*.

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\* The following are the observations which Hunter has left on record touching the mode of generation of the Eel and Lamprey :—

“ The natural history of the mode of propagation in the common Eel has, I believe, never yet been described, and this has probably in some degree arisen from a dissimilarity between their parts (of generation) and (those of) fish in common, so as not to be able to reason from analogy ; and as the mode of propagation in animals can only be known when that operation is going on in them, and by following it through most of its stages, it has lain almost unintelligible in the Eel, from the difficulty of finding them in this state. It was not even known whether they were oviparous or viviparous, and from this state of ignorance Sir John Hill has declared them viviparous, probably from conceiving it most probable, as their mode of propagation was so obscure as not yet to have been discovered. In many pursuits in Comparative Anatomy, especially the mode of propagation in fish, the Eel was not forgot, and as I found in this fish, parts situated similarly to the roes in other fish, although not similar in the immediate appearance for propagation, yet they were such as demanded attention ; therefore



it made me more desirous of knowing both the mode of propagation, and the use of these parts, if not intended for such purposes.

"That I might be able to ascertain these facts, I got Eels every month in the year from the fishmonger, with a view to catch them in the breeding season, as also of every size, but never could distinguish any difference in these parts in any of the months. However, I was told that this was not a fair trial, the fishmongers often keeping them for months in their troughs, in which time we cannot suppose they are going on with this process, and to get eels from the river regularly was not an easy matter.

"The part which I suspected to be the ovarium, when viewed with a magnifier, appeared a little granulated, like some fatty membranes; and there being in some of the amphibia, as the lizard, frog, &c., regularly formed bodies composed of fat, I boiled this part to see if any oil could be extracted; but it boiled away to a pulp without yielding any. Having failed in all my examinations on this part of the common eel, and being in the island of Belleisle in the summer of 1761, where there was a vast number of conger eels, I dissected some of them for their anatomy, and observed that they had the same parts with the common eel, which I had supposed to be the ovarium or roe. I then opened many to see if I could discover any spawn, but never succeeded.

"As the Lamprey and the Lampern have in some degree a similarity to the common eel, and their seasons of propagation are known, I next examined them with the same view when full of spawn, and easily found their parts for propagation, which are somewhat similar to those parts in the common eel, which I had suspected; and although not exactly so, yet was sufficient to show the analogy.

"So far encouraged I did not give up the pursuit in the common eel, and was further encouraged by Sir Joseph Banks mentioning that, when young, he had observed in an eel the roe full of eggs or spawn; but as he was then not well acquainted with the anatomy of this fish, and only knew there was an uncertainty respecting the mode of propagation, he therefore only preserved a part, and put it into spirits for further examination; but the spirits evaporating, it dried, and was rendered unfit for investigation. Sir Joseph Banks, giving me leave to look at some eels caught when on his voyage round the world, I found in them the roe full of eggs, and have since compared them with the common eel, in which I have at last discovered the mode of propagation, which is exactly what I suspected from the structure of the parts.

"On the present occasion it may not be improper to give a short description of the roe in the common roe-fish with a view to show the difference, which probably was the cause of its not being before discovered.

"The roe in fish in common, or what may be called 'roe-fish,' consists of two bags; in some these are long, extending nearly through the whole belly of the animal, in others round, &c. &c. They are smooth on the outside; and on the inside thrown into a number of flakes or folds, increasing the surface greatly for the form and attachment of the eggs or spawn. These bags terminate each in a duct near the anus, which ducts join each other, forming one, which enters the anus near the verge, through which the ova pass.

"In both the lamprey and lampern, the roes are not bags, having the ova attached to the folds on their inside, as in the above described, but are composed of flakes or layers attached at one base along the back, having no cavity. Each flake is composed of two membranes united by cellular membrane, and on the inside of each membrane are the ova, as close together as they can well be placed, and may be seen externally through the membrane composing the flake. When these fish have spawned

the flakes become flaccid, but still the nidi may be seen in little opaque spots. The mode of spawning I shall describe in the common eel. In the common eel, and also in the eonger, the roe is somewhat similar to the above, although not exactly. Each roe is composed of a membrane attached by one edge to the back of the fish, almost through the whole length of the abdomen, and continued into the tail, some way beyond the anus. The other edge is unattached, and is longer than the attached one, so that it hangs like a ruffle. On the sides of this membrane are a number of folds similar to the inside of roes in common, or similar to half of a common roe slit up through its whole length, having the smooth membrane on one side, and the flakes or folds on the other.

“Those roes in the lampern, lamprey, eonger, and common eel, have no duct or outlet directly belonging to them, therefore the operation of spawning is uncommon, and probably peculiar to this order of fish.\* The passage out appears to be by two openings, directly from the cavity of the belly just behind the rectum, which unites into one, and opens into the rectum on the further side of that gut just at the verge of the anus†. From this formation of parts, the question is, how do they spawn? In the common fish the parts themselves explain this operation, and in the present we must have recourse to the same method.

“In the common fish we must suppose that the ova fall off, and get loose into the cavity of the roe or ovarium, and then are protruded out of that cavity through the duct, by the action probably of both the roe and abdominal muscles, which forces them externally.

“In the eel, &c. we must suppose them forced out at the small opening above-mentioned by the same kind of action.

“From the structure of the parts, this method of accounting for the operation of spawning appears to be the only possible one; and although it may be difficult to conceive how the spawn, when loose in the cavity of the abdomen, should all be brought to these small openings, and there make their exit, yet it may not be the less true; and that this is the most probable way is still more strengthened by my having seen the eggs in the lampern, whose structure is the same, loose in the cavity of the abdomen in their season for spawning, and others that were not detached, upon the least handling dropped off from the ovaria‡.

“This structure, although in some respects appearing calculated for the formation of the spawn, yet, as that spawn had not been seen, and as there was no visible outlet for the spawn, when detached,

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[\* The proper oviducts are wanting also in the Salmon Tribe.—R. O.]

† All of the ray kind have two openings from the belly, one on each side by the fin at the anus.

[‡ A Correspondent of Loudon's Magazine of Natural History thus narrates some of the phenomena of the generation of the lamprey, of which he was an eye-witness:—

“On the 8th May I observed a number of lampreys in the act of spawning; and, remembering the queries of your correspondent, I stood to watch their motions. I observed one twist its tail round another, and they both stirred up the sand and small gravel from the bottom in such a way as convinced me it was a conjunction of the sexes: each sexual conjunction was followed by the ejection of a jet of eggs from the female. I caught them both, and dissected them: the sexual organ in the male was projected above a quarter of an inch, and the body filled with milt; the female, though she seemed to have already shed a considerable quantity of her spawn, had still a tolerable stock remaining.”—Vol. v. p. 745.—R. O.]

3202 A. A section of an Eel (*Anguilla latirostris*, YARRELL), showing the posterior portions of both ovaria\*.

*Presented by William Yarrell, Esq. F.L.S.*

3203. The ovaria, and a portion of the air-bladder of a Salmon (*Salmo Salar*, LINN.). Each ovarium is a closed sac, as in the Eel and Lamprey, but has an internal cavity and an undivided exterior. A portion of the capsule has been removed from one side of each lobe, showing the transverse

belonging to these parts themselves, as in other fish, it was no wonder that in some it remained a doubt whether they were the parts or not. This having no outlet belonging to the parts themselves is a curious fact."—*Hunterian Manuscript*.

[Mr. Couch, the acute Ichthyologist of Polperro, Cornwall, bears the following testimony to the oviparous propagation of the eel:—"If any one examine the fat-like fringe on the sides of the air-bladder and kidneys of the eel and conger, he may, with a common pocket lens, and often without the aid of a glass, see an abundance of ova from the *beginning of the year to about September*, between which months the growth of the ova was traced to their full size and ultimate exclusion, becoming plain to the naked eye, and at last the ovaria emptied.

"In other specimens I found parts which were like the ovaria in form and general appearance; but differing in consistence, and growing to a state of apparent *ripeness*, and not showing globular forms like eggs at any time.

"The milters, which run smaller, are often more in number than the spawners, but the sexes are perfectly distinct."—*Loudon's Magazine*, vol. v. p. 313.]

[\* Mr. Yarrell states that "The passage of the young eels up the Thames at Kingston, in the year 1832, commenced on the 30th of April, and lasted till the 4th of May. Some notion may be formed of the quantity of young eels, each about three inches, that pass up the Thames in the spring, and in other rivers at the beginning of summer, from the circumstance that it was calculated by two observers of the progress of the young eels at Kingston in 1832, that from sixteen to eighteen hundred passed a given point in the space of one minute of time."—*British Fishes*, ii. p. 291. The same experienced naturalist states "That eels breed also in the fresh water of inland rivers and lakes, from which they are unable to visit the sea, is, I believe, certain."—*Ibid.* p. 293.

Mr. Yarrell's observations on the oviparous generation of eels are given in the Second Series of Mr. Jesse's Gleanings in Natural History.

It appears that eels do not breed in fresh water, save in such exceptional cases; but that there are regular migrations of pregnant ones from the inland waters to the sea, or to the mouths of rivers, at the end of summer; and of *elvers*, or young eels, from those situations to the fresh waters in spring. These, having passed gradually from the salt to fresh water, ascend streams and drains, and spread themselves through the inland waters.

The breeding-eels are stated to descend the river Yarrow at the end of September.

The young eels, or *elvers*, ascend the river Connor about the 20th of May in a slender column one and a half or two feet wide, along the edge of the stream.—R. O.]



or slightly oblique folds of the ovigerous membrane, here loaded with ova and ovisacs ripe for dehiscence. (See No. 2661.)

3204. Numerous mature ova of the Salmon, removed from the peritoneal cavity, after the dehiscence of the ovisacs\*.

3205. The trunk of a Barbel (*Cyprinus Barbus*, LINN.), with the anterior parietes of the abdomen and the intestine removed, to show the female organs, with the ova pretty far advanced in their development. The

\* By the observations and experiments of Mr. Alexander Shaw, of Drumlanrig, the following important facts in relation to the development of the Salmon have been determined.

In the river Nith, Dumfries, the salmon oviposits in the month of January. On the 10th of January 1836, Mr. Shaw observed a female salmon of about 16 lbs. weight, and two males of at least 25 lbs., engaged in depositing their spawn. The spot which they had selected for that purpose was a little apart from some other salmon which were engaged in the same process, and rather nearer the side, although still in pretty deep water. The two males kept up an incessant conflict during the whole of the day for possession of the female, and, in the course of their struggles, frequently drove each other almost ashore, and were repeatedly on the surface displaying their dorsal fins, and lashing the water with their tails.

The female throws herself at intervals of a few minutes upon her side, and while in that position, by the rapid action of her tail, she digs a receptacle in the gravel for her ova, a portion of which she deposits, and again turning upon her side, she covers it up by a renewed action of the tail: thus alternately digging, depositing, and covering the ova, until the process is completed by the laying of the whole mass, an operation which generally occupies three or four days.

The embryo-fish, conspicuous by the two dark eye-specks and the vascular vitelline sac, presented some appearance of animation on February 26th, that is forty-eight days after being deposited; and on the eighth of April, or ninety days after impregnation of the ova, the young were excluded. The head is large in proportion to the body, which measures five-eighths of an inch in length; the vitelline sac is two-eighths of an inch in length, and resembles a light-red currant: the tail is margined, like that of the tadpole, with a continuous fin running from the dorsal above to the anal beneath. The vitelline sac and its contents are absorbed by the 30th of May, or in about fifty days, until which time the young fish does not leave the gravel. The terminal fringe-like fin now begins to divide itself into the dorsal, adipose, caudal and anal fins; and the transverse bars on the sides of the body make their appearance. At this period the young salmon measures an inch in length, and is very active. It continues in the shallows of its native stream till the following spring, when it has attained the length of from three to four inches, and is called the "May Parr." They now descend into deeper parts of the river, but remain there over the second winter. In the month of April of their second year the caudal, pectoral, and dorsal fins assume a dusky margin, the lateral bars begin to be concealed by a silvery pigment, and the migratory dress, characteristic of the salmon fry, or "Smolt," is assumed. The fish now begin to congregate in shoals, and to migrate sea-ward.—See *Transactions of the Royal Society of Edinburgh*, vol. xiv. p. 547.

ovigerous laminæ are here, as in the salmon, inclosed in a membranous capsule; but this is continued posteriorly in the form of a short oviducal canal, which almost immediately unites with its fellow to form the common oviduct, by which the ova are conveyed directly outwards: a glass rod is inserted into the genital outlet, which is posterior to the anus, as in fishes generally.

- 3206. The trunk of a Carp (*Cyprinus Carpio*, LINN.), with the ovaria in their state of full development, and the common short and wide oviduct protruding from the genital outlet: a longitudinal section has been removed from one of the ovaria, to show the compact arrangement of the ova.
- 3207. A Gold-fish (*Cyprinus auratus*, LINN.), with the parietes of the right side of the abdomen removed, to expose the right ovarium, which is loaded with mature ova.
- 3208. A Gold-fish, with the left ovarium similarly exposed, and its capsule removed to show the ovigerous laminæ, which are turgid with mature ovisacs and ova.
- 3209. A Dace (*Leuciscus vulgaris*, CUV.), with the right ovarium similarly displayed.
- 3210. One of the ovaria of a Cod (*Gadus Morrhua*, LINN.), laid open, and the ovigerous laminæ with the countless ovisacs and ova displayed; the parts have been injected. The cod spawns in the month of February, and it has been calculated that the number of ova in the roe of one female exceeds nine millions.
- 3211. The posterior moieties of the ovaria of a Goby (*Gobius*, LINN.). (?). The ovigerous laminæ and ova have been removed from one of the ovaria, and a bristle is inserted into the part of the capsule which is continued into the oviduct.
- 3212. One of the ovaria and both oviducts of a Shad, from the Severn (*Alosa communis*, CUV.). The ovarium has been injected and laid open to show the vascularity of the numerous oblique ovigerous laminæ, and the nearly contemporaneous development of the very numerous ova therein contained.

3213. The ovaria and oviducts of a Mackerel (*Scomber Scombrus*, Cuv.). One of the ovaria is laid open longitudinally to show the ovigerous laminae and ova.
3214. A similar preparation.
3215. The ovaria and oviducts of a Mackerel, both of which are laid open : the oviducts are extremely short.
3216. A portion of one of the ovaria of a Pike (*Esox Lucius*, LINN.), minutely injected and laid open to show the ovigerous lobes and equably developed ova.
3217. The Father-lasher (*Cottus bubalis*, Cuv.), with the ventral parietes of the abdomen removed to display the ovaria *in situ*. This species spawns in January, at which time the ova are of a fine orange colour.
3218. The anterior or caecal extremity of one of the ovarian sacs of an Angler (*Lophius piscatorius*, LINN.). It is injected and everted to show the extent of the ovigerous portion of the lining membrane, and the vascularity and disposition of the ovisacs.
- 3218 A. A section of the ovigerous portion of the wide ovarian sac of the Angler (*Lophius piscatorius*, LINN.), showing the ovisacs developed in groups of three or four, projecting from the internal or mucous surface, and arranged in interrupted linear series : both arteries and veins are injected. *Prepared by Mr. Owen.*
3219. The ovaria and single wide oviduct inverted of the Wolf-fish (*Anarrhichas Lupus*, LINN.). The boundary of the ovigerous mucous membrane is well defined, its surface is increased by numerous broad and flattened processes, which, from the state of development of the ovisacs and ova, present a granulated surface. The ovisac consists in this, as in other fishes with hollow ovaria, of the ovarian vesicle, a thin layer of cellular tissue or stroma, and an external coat of mucous membrane.
3220. The pyriform ovarian sacs, oviducts, and rectum of the Electric-eel (*Gymnotus electricus*, LINN.). One of the ovaria is laid open to show



the coarsely granulated inner surface, occasioned by the large ovisacs and ova projecting therefrom.

3221. One of the ovaria of the Electric-eel, laid open to show the ovisacs and ova, further developed.
3222. A similar preparation.
3223. A female Pipe-fish (*Syngnathus Typhle*, LINN.), with part of the walls of the abdomen removed to show the ovarian tubes and ova. There are no subcaudal plates in this sex, and the vulva is unusually prominent, in order to convey the ova into the marsupium of the male.
3224. A female Pipe-fish, (*Syngnathus Æquoreus*, LINN.), with the tail cut off, and the ovarian tubes and ova exposed. The ova are smaller and more numerous in this than in the preceding species.
3225. A section of the Great Pipe-fish (*Syngnathus Acus*, LINN.), with the right ovary displayed *in situ*: a portion of the subcaudal integument has been dissected off, probably in quest of some trace of the marsupial structure, which, since Hunter's time, has been discovered to be peculiar to the male.
3226. A male Pipe-fish (*Syngnathus Typhle*, LINN.), with the subcaudal plates divaricated to show the impregnated ova in the marsupial cavity.
3227. The male of the same species of Pipe-fish, with the marsupial cavity similarly displayed, at the period of completion of the incubation of the ova; some of the embryo *Syngnathi* still remain in the pouch, and the cellular structure of the posterior part to which the ova were attached is well shown.
3228. The male of an exotic species of *Syngnathus*, in which the marsupial valves and cavity occupy the whole of the under or ventral surface of the abdomen: the valves are divaricated to show the numerous ova therein contained; a bristle is inserted into the anus.
3229. The male of the *Syngnathus Ophidion*, (BLOCH,) in which the ova, after exclusion from the female and impregnation, are attached to the cellular surface of the ventral parietes of the abdomen, but are not protected by cutaneous processes or valves.

3230. A male Hippocamp (*Hippocampus guttulatus*, Cuv ), with the marsupial pouch laid open on the right side, showing the contained ova, and the cellular internal surface of the marsupium to which they are attached ; the natural orifice of the incubative pouch is a vertical fissure just below the anus.
3231. A male of the same species of Hippocamp, with the right parietes of the marsupial pouch removed to show the young Hippocamps at nearly the completion of their development.
3232. A portion of the ovarium of a Monk-fish (*Squatina Angelus*, DUM.), with the ovisacs and ova in very different stages of development, differing in this respect, in a marked degree, from the ovarium of the osseous fishes, and resembling that of the higher vertebrate animals. The ovisacs do not project far from the surface of the ovarium.
3233. The ovaria, oviducts and part of the liver, showing the common opening of the oviducts at the anterior part of its broad ligament, of a viviparous cartilaginous fish. The ovarian ova exhibit the unequal development characteristic of the highest order of fishes, in which impregnation takes place within the body : a few have arrived at maturity ; they present a spherical form, and exceed an inch in diameter. The terminal or uterine segment of one of the oviducts is laid open to show the characteristic wavy parallel folds of the lining membrane.
3234. The glandular portion of the oviduct of a large Homelyn (*Raia maculata*, MONTAGU). A longitudinal section has been removed from one of the lobes of the nidamental gland, exposing to view the flattened inner surface of the opposite lobe, on which may be seen the free margins and interspaces of the close-set transverse layers of secreting tubes, from which the albuminous secretion passes into the cavity of the oviduct. The arrangement of the converging component capillary tubuli of the gland is displayed on one of the divided surfaces of the lobe.
3235. Two ova of a large species of Homelyn (*Raia*), each containing a completely developed embryo. In one ovum the nidamental tunic and chorion are reflected, so as to expose the dorsal aspect of the embryo ; and in the other the ventral surface is displayed. The broad pectoral

fins are bent upon the back, and the tail is curved around the left side of the body: the external yolk occupies a considerable pyriform sac—the vitelliculum\*, pendent by a short and contracted neck from the centre of the under surface of the disciform body of the fish.

3235 A. The ovum of the antarctic *Chimæra* (*Callorhynchus antarcticus*, Cuv.).

The brown horny nidamental covering is produced from the lateral circumference of the elliptical ovum in the form of a broad plicated plate fringed at the margin. *Presented by Sir Everard Home, Bart.*

3235 B. The nidamental case and chorion of the ovum of the same species, from which the embryo and vitelline tunic have been removed.

*Presented by Sir Everard Home, Bart.*

3236. The impregnated oviducts of a Skate (*Raia Batis*, LINN.). The nidamental glands are laid open longitudinally, showing the thickness of the secreting lamellæ. The ovum, coated with the albuminous or horny secretion of the gland, may be discerned through the thin coats of one of the oviducts: the corresponding portion of the other has been laid open, and the ovum removed.

3237. The ovum removed from the preceding oviduct, with a part of the chorion and the adherent nidamental secretion reflected downwards, and the membrana vitelli and yolk displayed. The outer layer of the albuminous secretion is silky and flocculent; it becomes in part condensed into horny firmness, and is in part washed off by the action of the seawater when excluded.

3238. A similar preparation, with a portion of the oviduct attached. The flattened oblong quadrangular form, with the angles prolonged into filamentary processes, characteristic of the Skate's egg, is shown in both this and the preceding specimen.

3239. The cloaca and one of the oviducts of a Skate, with the glandular portion divided longitudinally, and the succeeding wide membranous canal laid open to expose the ovum, coated with the nidamental secretion *in situ*.

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\* Yolk-bag, vitelline sac, 'vesicula umbilicalis' of Human Anatomy.



3240. The other oviduct of the same Skate, showing the nidamental gland entire, and the ovum inclosed in the case formed by its secretion *in situ*.

3240 A. A foetal Skate, exhibiting the external vitelline sac.

*Presented by William Lawrence, Esq., F.R.S.*

3240 B. A similar specimen.

*Presented by Mrs. Robinson.*

3241. A foetal Ray, injected and dissected to show the heart, the branchial vessels, the alimentary canal, and the communication therewith of the external and internal yolks. A section of the dermal or serous, and of the mucous tunic of the external yolk-bag has been taken from one side, and the contents of the bag removed. The internal yolk, formed by a dilatation of the part of the vitellicle within the abdomen, the deep brown vitelline matter, and the orifice by which the internal vitellicle communicates with the intestine, are clearly displayed. The heart, and its broad bi-appendiculated auricle, the bulbus arteriosus, and its two primitive branchial arteries, with their division on each side, are shown; and on the opposite side, the union of the branchial veins and the aortic trunk is exhibited.

3242. A young Torpedo (*Torpedo Narke*, Cuv.), with the ventral parietes of the abdomen removed, to show the remains of the internal yolk, and its connexion with the short 'intestinum tenue' which intervenes between the duodenum and the wide valvular large intestine.

3243. A young Torpedo (*Torpedo Narke*, Cuv.), at the period of growth when the external yolk has been absorbed and the vitelline sac wholly drawn in: the abdomen has been opened by a crucial incision.

3244. A Torpedo further advanced in growth, with the abdominal viscera removed, and the abdominal muscles dissected.

3245. The ovum of a Shark, from the South Seas. It is of an elliptical form, with the extremities truncated, and their angles produced into long, contorted, tendril-like filaments; but its chief peculiarity is the presence of a regular series of parallel ridges, extending somewhat obliquely across the anterior and posterior surfaces of the nidamental tunic. There are

fifteen of these ridges on each side of the present ovum, which has been slit open and the contents removed.

- 3245 A. The nidamental envelope of a similar ovum of a Shark, from the South Seas. There are upwards of twenty ridges on each side of the present specimen. *Presented by Sir Joseph Banks, Bart.*

3246. The oviducts of a Spotted Dog-fish (*Scyllium Canicula*, Cuv.), exhibiting the nidamental glands which secrete the horny albuminous membrane of the ovum, a portion of the narrow membranous part of the oviduct anterior to the gland, and the wider posterior part, as far as its termination at the cloaca. One of these terminal portions of the oviduct is laid open, to show the plicæ of the lining membrane.

3247. The ovum of a Spotted Dog-fish. It is smooth on both the anterior and posterior surfaces.

3248. The nidamental envelope of the ovum of the Spotted Dog-fish.

3249. The ovum of the Spotted Dog-fish laid open, to show the embryo and its appended external vitellicle or yolk-bag: the embryo is about an inch in length: the development of the external branchiæ has commenced.

3250. The embryo and its appended vitellicle of the Spotted Dog-fish, about two inches in length, exhibiting the external branchiæ fully developed.

3251. The ovum of the Spotted Dog-fish, with a portion of the tunics removed, to show the contained embryo further advanced in development, and with the external branchiæ absorbed.

3252. Two ova of the Spotted Dog-fish, each with their contained embryo and its appended vitellicle, similarly exposed, and exhibiting the same stage of development as the preceding preparation.

3253. The ovum of the Spotted Dog-fish, with a more advanced embryo, and its vitellicle displayed *in situ*.

3253 A. The ovum of the Spotted Dog-fish, with the embryo removed and suspended above the egg-case, showing the form of the vitellicle and its duct. *Presented by Mrs. Robinson.*

- 3253 B. The embryo of the Spotted Dog-fish removed from the ovum, and showing the diminution in the size of the external vitellicle.

*Presented by Mrs. Robinson.*

3254. The ovum of the Spotted Dog-fish, with the embryo at an advanced period of development exposed *in situ*, and with the ventral parietes of the abdomen removed, to show the internal vitellicle developed at the expense of the external one, which has nearly disappeared.

3255. The uterine or terminal segment of one of the impregnated oviducts, with the cloaca of the Picked Dog-fish (*Spinax Acanthias*, Cuv.), injected and laid open, and one of the embryos which it contained exposed *in situ*; it is about two inches long, and exhibits the full development of the external branchiæ; the vitellicle presents a great proportional size. The sea-water would seem to be admitted freely by the wide terminal apertures of the oviducts into their cavity; so that whilst the vitellicle ministers to the nutriment of the embryo, the external branchiæ can perform efficiently the respiratory function. Bristles are inserted into the openings of the ureters.

3256. The uterine or terminal segments of the impregnated oviducts of the Picked Dog-fish: one of these is laid open, and two of the contained embryos, far advanced in development, being six inches in length, are displayed; the external vitellicle is, notwithstanding, of large size.

3257. The external and internal vitellicle and intestinal canal of the foetal Picked Dog-fish. The internal vitellicle is here comparatively very small, and is a mere cæcal development of the terminal part of the vitellicle duct, which is seen communicating with the end of the small intestine.

- 3257 A. A foetal Picked Dog-fish, showing the form and size of the external vitellicle and its duct.

*Presented by Mr. Clift.*

- 3257 B. A similar specimen further advanced in growth, and with the external vitellicle proportionably diminished in size.

*Presented by Mr. Clift.*

3258. The uterine segments of the oviducts of an ovoviviparous Shark



(*Spinax*): one of these is laid open, exhibiting a fœtus far advanced in development, and with the external vitellicle comparatively small and collapsed.

3259. A fœtus of a *Spinax*, apparently of the same species, with the right side of the abdominal parietes removed, to show the passage of the yelk-duct to the intestine.
3260. The embryo of a Shark (*Squalus*, LINN.), with the external branchiæ fully developed: the cornea transparens of the eye is not completely closed.
3261. A fœtal Shark, injected, and with the left side of the abdominal parietes removed to show the course of the vitelline duct to the intestine. The heart and branchial vessels of the left side are likewise exposed.
3262. The fœtus of a Shark, with the duct of the vitellicle appended to the abdomen.
3263. The fœtus of the Saw-fish (*Pristis Antiquorum*, CUV.), with the duct of the vitellicle. The rostral teeth present the condition of mere cutaneous papillæ.

### SERIES XIII. In Reptiles.

a. Metabolian Sub-class, in which the young undergo a Metamorphosis.

3264. The ovaria, oviducts, rectum, kidneys, ureters, allantois and cloaca of the Menopome (*Menopoma Alleghaniense*, BL.). The ovaria consist each of a long and broad plicated membrane, inclosing a loose and transparent cellular tissue or 'stroma,' in which the ovisacs and ova are formed. These are of a spherical figure, and the majority present an advanced stage of formation, having a diameter of two lines. The oviducts are long sub-compressed canals, and are disposed in short transverse folds: they commence each by a distinct and free abdominal aperture. Bristles are inserted into the cloacal outlets of the oviducts and into the allantois.
3265. A female Newt (*Triton palustris*, LAUR.), with the ventral parietes of the abdomen removed to show the ovaria distended by mature ovisacs and ova, and the long and tortuous oviducts behind the ovaria.

3266. A similar preparation, in which may be observed the prominence and tumidity of the vulva peculiar to this period of sexual excitement.
3267. A female Newt (*Triton cristatus*, LAUR.), with the ventral parietes of the abdomen removed, to show the ovaria, laden with mature ova, *in situ*, anterior to which may be seen the commencement of the oviducts distended by the abundant albuminous secretion prepared by them at this period.
3268. A specimen of the same species of Newt, similarly dissected, to show the mature ovaria, recently emptied of the ova, which now distend the largely developed oviducts: a bristle is placed in the abdominal or anterior aperture of the left oviduct.
- 3268 A. The larva of the same species of Newt, exhibiting the three fimbriated external branchiæ on each side: the tail has been accidentally shortened in this specimen. *Presented by Dr. Leach.*
3269. A larva of the same species of Newt, further advanced in development, with the last remains of the external branchiæ visible externally, and the tail of the natural length\*.
3270. A Frog (*Rana temporaria*, LINN.), with the ventral parietes of the abdomen and the alimentary canal removed, to show the left ovary and the oviducts *in situ*: a bristle is placed in the abdominal aperture of the right oviduct. The termination of the rectum and the cloaca are laid

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[\* When the larva of the Newt quits the ovum it is neither provided with lungs nor locomotive extremities: it breathes water by means of three pairs of simple external branchial appendages, swims by the lateral movements of a vertical membranous caudal fin, and adheres to aquatic plants or other foreign bodies by two temporary prehensile organs situated at the sides of the mouth. The fore-legs are first developed, and at the twelfth day have become elongated and provided with digital processes at their extremities: the hind-legs make their first appearance about the twenty-second day, when the development of the lungs is also indicated by the emission of air-bubbles from the mouth of the larva: at the thirty-sixth day the lungs have attained half the length of the abdominal cavity, and up to this period the external branchiæ have acquired progressive increase of size and complication. At the forty-second day the branchiæ begin to be rapidly absorbed, and in about five days they are reduced to simple prominences, situated upon the opercular fold of integument which covers the gill-openings at the sides of the neck. These openings are now soon obliterated; the membranous fin of the tail contracts, and is thickened, and coloured with the pigmental secretion: the lungs and locomotive extremities are perfected, and the condition and habits of the perfect Newt are thus acquired.]

open, and bristles are inserted into the cloacal apertures of the oviducts, and into the allantoic or urinary bladder. The ovarian ova have completed about half their progress towards maturity.

3271. A similar preparation, exhibiting the ovarian ova maturely developed; one part of the circumference of the vitellus is obscured by a dark substance, which has been found to consist of a stratum of cells containing a dark pigment.
3272. The ovaria, oviducts, alimentary canal and cloaca of a Frog. The ovarian ova are nearly mature.
3273. A portion of the ovarium of a Frog, with the ova fully matured and the ovisacs ripe for dehiscence.
- 3273 A. A Bull-frog (*Rana pipiens*, LINN.), with the ventral parietes reflected from the cavity of the abdomen, to expose the mature ovaria *in situ*.

*Prepared by Mr. Clift.*

3274. A large species of Toad (*Bufo*, LAUR.), with the ventral parietes of the abdomen removed, and the ovaria with the mature ova blackened by the pigmental cells on the superficies of the vitellus exposed *in situ*.
3275. A similar but larger specimen of the same species of Toad, with the mature lobulated ovaria more completely displayed.
3276. The ovaria of a large Toad; they are laid open to show the ovisacs containing the mature ova projecting into the interior of the cavity and covered by its smooth lining membrane.
3277. A Surinam Toad (*Pipa monstrosa*, LAUR.), with the ventral parietes of the abdomen and intestinal canal removed, to show the ovaria and oviducts *in situ*. The ovarian ova are mature, of a spherical form, between two and three lines in diameter. The oviducts are, as usual, of great length, and are disposed in numerous convolutions on each side of the broad ovarium.
3278. The ovaria, laden with mature ova, and with its fatty appendages, of a Surinam Toad: the black pigment is confined apparently to that small part of the circumference of the vitellus which is the seat of the germinal vesicle.



3279. A Frog (*Rana temporaria*, LINN.), with the ventral parietes of the abdomen removed to show the uterine portions of the oviducts distended with ova, which have now acquired their albuminous covering and chorion.
- 3279 A. A similar preparation, with the intestinal canal and convoluted parts of the oviducts likewise displayed. The thin walls of the uterine dilatations are partially removed, to show the contained impacted ova.

*Prepared by Mr. Clift.*

3280. The impregnated ova of a Frog (*Rana temporaria*, LINN.), with the albumen and chorion distended by imbibition of the water in which oviposition has taken place.
3281. Another portion of Frog-spawn, consisting of the aggregated and impregnated ova of the *Rana temporaria*.
3282. A series of the young of the Frog (*Rana temporaria*, LINN.), showing the external changes which occur during the progress of the metamorphosis from the larva or tadpole to the mature state.

At first, the only organ of locomotion is a compressed vertical tail, as seen in the lowest specimens; then the hinder pair of extremities, and afterwards, when the larva has attained its full size, the fore pair of legs appear: as these terrestrial locomotive organs increase, the tail, or swimming organ, diminishes, and finally disappears. Branchial respiratory organs in like manner are first developed, and then give place to pulmonary sacs: vertebræ, with cupped articulations fitted for the elastic movements of a natatory caudal fin, are converted into a firmer chain of bones, articulated by ball-and-socket joints, when the four extremities for supporting the body on dry land are developed. A horny beak is exchanged for a wide mouth with teeth; and a complex alimentary canal adapted for a vegetable or mixed diet in the voracious larva is much simplified before the mature state is acquired. These are the principal internal changes which accompany the metamorphosis of the external parts illustrated in the present preparation.

3283. Four larvæ of the common Frog (*Rana temporaria*, LINN.). The two lower specimens exhibit the first development of the hinder extremities; the two upper specimens show the final disappearance of the tail.

3284. The larva of a large species of Frog, with both the anterior and posterior extremities developed, but with the tail still of considerable length.
3285. A larva of the same species of Frog, with the terrestrial locomotive extremities further advanced in development, and with the tail proportionally reduced in size.
3286. A larva of the Jackie, or Fish-frog (*Rana paradoxa*, LINN.), about an inch and a half in length: no other locomotive organs are developed, excepting the tail: the whole body is invested with a thin, smooth and semi-transparent integument, a broad duplicature of which extends both above and below the caudal prolongation, increasing the power of that part as a swimming organ. The mouth is small, and is provided with thin horny mandibles. The eyes are wholly unprotected, and the cornea is incomplete. There is no trace of external gills, but the situation of the subsequent single branchial outlet is indicated by a subcircular line, resembling a cicatrix on the left side of the head a little below and behind the eye. The spiral coils of intestine are visible through the parietes of the abdomen.
- 3286 A. A larva of the same species of Frog between two and three inches in length, presenting the same general conditions as the preceding specimen. The horny mandibles of the small transverse mouth have assumed a darker colour; the convoluted intestine exhibits an increase in length: the commencement of the formation of the cornea from the upper part of the sclerotica may be noticed: the temporary cutaneous cloacal passage common to the rectum and the ducts of the transitory kidneys, is clearly exhibited in both this and the preceding specimen.

*Mus. Langstaff.*

3287. A similar preparation of increased size, showing an increased number of coils of the intestine; the nostrils are here conspicuous upon the upper lip in the form of minute simple circular apertures. The cicatrix-like indication of the branchial aperture on the left side of the head, noticed in the preceding specimens, is here very conspicuous. The muscular apparatus of the tail is increased in bulk.

- 3287 A. A larger larva of the same species, but presenting the same general conditions of development; the horny armature of the mouth now presents the form of two dark dentated lines on each mandible; the abdominal cavity exhibits an enlargement proportionate to the increase in both the number and size of the convolutions of the intestinal canal. A brown pigment has begun to be developed beneath the cuticle.

*Mus. Langstaff.*

- 3287 B. A larger larva of the same species, with the pigmental system of the external teguments fully developed; a small papilla on each side of the cutaneous cloaca indicates the first appearance of the posterior extremities. This larva is about four inches in length.

*Presented by W. M. Ireland, Esq., M.R.C.S.*

- 3287 C. A larva of the same species of Frog, five inches in length, in which the posterior extremities project about two lines from the external surface, and are proportionally slender; the cornea of the eye is so far developed as to leave only a small elliptical aperture in front of that organ: the external nostrils slightly project in a tubular form. The abdomen is laid open, and the coils of intestine are exposed.

*Presented by W. M. Ireland, Esq., M.R.C.S.*

- 3287 D. A larva of the same species of Frog, nearly six inches in length, with the different segments of the posterior extremity, and the digits and their natatory webs perfectly developed; the whole member does not exceed half an inch in length: the transparent cornea is completely closed: the caudal fin is still of considerable breadth, but the cutaneous portion is become thickened and has lost its transparency. The cicatrix on the left side of the head below the eye is still very conspicuous: two minute apertures are situated immediately beneath it in this preparation: there are no corresponding apertures on the opposite side.

*Presented by W. M. Ireland, Esq., M.R.C.S.*

- 3287 E. Another larva of the same species of Frog, showing a more conspicuous development of the labial fold of integument surrounding the transverse mouth; the margin of this fold is fringed: the cicatrix-like mark on the



left side of the head, noticed in the preceding specimens, here presents the condition of an operculum protecting a small vertical aperture, which forms the outlet of the cavity containing the internal gills. The hind extremities are nearly an inch in length.

*Presented by W. M. Ireland, Esq., M.R.C.S.*

- 3287 f. Another larva of the same species of Frog further advanced in growth, with the opercular gill-aperture fully formed, and the hind legs upwards of two inches in length. *Presented by W. M. Ireland, Esq., M.R.C.S.*

- 3287 g. A larva of the same species of Frog, measuring eight inches in length and upwards of two inches in the vertical diameter. The hind legs have attained the length of three inches; but as yet there is no appearance of anterior extremities: the tail has now acquired its largest dimensions.

*Presented by W. M. Ireland, Esq., M.R.C.S.*

- 3287 h. A larva of the same species of Frog, farther advanced in development, but much diminished in bulk, showing considerable diminution of the tail, with an external protrusion of the anterior extremities, which are about one-third the dimensions of the posterior pair: the single branchial aperture is situated immediately anterior to the left fore-foot. The mouth begins to exhibit a marked increase in width: the fringe on the margin of the continuous labial fold is still apparent. The formation of the palpebral apparatus has commenced by a fold of the integument beneath the eye.

*Presented by W. M. Ireland, Esq., M.R.C.S.*

- 3287 i. A larva of the same species of Frog, farther advanced in both growth and development. The fore extremities, although still small, are completely formed; the branchial aperture is obliterated; the hind extremities have acquired their normal proportions: the tail is shortened and considerably thickened, and its marginal membranous expansions are nearly lost. The temporary membranous cloaca is now detached from the true anus. The jaws are completed, and the mouth has assumed the ordinary mature form. The apertures of the nostrils are diminished in size. The inferior eyelid is completed.

*Presented by W. M. Ireland, Esq., M.R.C.S.*

3287 κ. A specimen of the *Rana paradoxa*, with the tail almost completely absorbed, but presenting in other respects the ordinary characters of a mature frog. The contrast in respect of size between this specimen, as compared with that of the larva, No. 3287 γ, presents an extreme case of a condition common to most animals which undergo a similar metamorphosis, inasmuch as the voracious larva at the full period of its growth presents in the Metabolian insects, as well as in many of the Batrachians, a greater bulk than the imago at the close of the metamorphosis.

*Presented by W. M. Ireland, Esq., M.R.C.S.\**

3288. The larva of the same species of Frog prior to the development of the terrestrial locomotive extremities, with the abdominal cavity laid open to exhibit the spiral coils of the enormously developed intestine.

3289. The intestinal canal, with part of the liver, pancreas and spleen of a full-sized larva of the *Rana paradoxa*.

3290. The larva of the same species of Frog after the protrusion of the anterior extremities, with the abdominal cavity laid open to show the diminution in the size of the intestinal convolutions. One side of the tail is dissected to show the cartilaginous and membranous condition of the vertebræ which are in progress of absorption.

3291. The larva of the Bull-frog (*Rana pipiens*), just before the anterior

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\* Mr. Ireland, in his account of the external changes which take place in the Surinam Frog, states that the little hind-legs, as exhibited in the specimen, No. 3287 β, arrive, in about a fortnight, at the size displayed in No. 3287 ρ, and the body of the animal is very much enlarged: during this change, the larvæ, which were confined in a tub of water with growing plants, remained at the bottom of the vessel in a dormant state. In about three weeks the animal became more active and lively, and the fore-legs made their appearance as in No. 3287 η. "During this period the animal remains suspended in the water, with its mouth above the surface, for the purpose of breathing atmospheric air; but the moment it perceives anything move it dives to the bottom, where it remains a few minutes, and then returns to its former position. From this period until about the sixth week the animal is always seen with part of its head above the surface of the water, and is so extremely active and strong, that should the vessel be left uncovered for half a minute it leaps out and jumps six or eight feet at a time. During this last period of the change, the tail, or that part which is behind the legs, partly sloughs off and is partly absorbed; that is, the outer and thin part of the tail gradually falls off by bits, while the inner and thicker part is absorbed, till the whole is gone to the line marking the part which is to be separated."—*Journal of Science and Arts*, vol. i. p. 55, 1816.

extremities begin to protrude, showing on the right side the thinning of the skin by absorption for that purpose, and on the left side the cutaneous cavity containing the rudimentary fore-leg. The branchiæ of this side are likewise exposed, and a bristle is passed from them through the single branchial aperture, which is situated, as in the preceding species, on the left side of the head. The lungs are exhibited in the abdominal cavity, presenting the form of narrow fusiform sacs, their posterior extremities not quite reaching to the corresponding boundary of the abdominal cavity. The heart is exposed within the pericardium; the internal apertures of the nostrils, which form the most constant distinction between the Fish and Reptile, are displayed at the upper part of the mouth; the flattened pale-coloured kidneys are well contrasted against the yellow Wolffian bodies situated external to them. The separation of the temporary from the permanent cloaca is likewise well exhibited in this instructive preparation.

- 3292. The liver and alimentary canal of the larva of the Bull-frog about the same period of development.
- 3293. A female Surinam Toad (*Pipa monstrosa*, LAUR.), with the abdominal cavity laid open, and the alimentary canal and liver removed, to show the shrivelled ovaria and the collapsed convoluted oviducts, into the abdominal apertures of which bristles are inserted. The ova have been expelled, impregnated, and received into the dorsal cutaneous cells, some of which are laid open, and others apparently ruptured by the young in their efforts to escape: these have reached the completion of their metamorphosis, the legs being completely developed and the tail absorbed.
- 3294. A vertical section of a female Surinam Toad, showing the structure of the cutaneous dorsal marsupial cells, many of which, having been deserted, are in progress of obliteration by the thickening and adhesion of their original walls.
- 3295. A young Surinam Toad at the completion of its metamorphosis.
- 3296. A female Salamander (*Salamandra maculosa*, LAUR.), with the left parietes of the abdomen removed to exhibit the left oviduct impregnated and *in situ*: it contains numerous foetal salamanders, each about an inch in



length ; they lie coiled upon themselves and disposed for the most part transversely to the axis of the canal ; they may be readily distinguished by the dark pigment and opaque white lens of the eye ; and in some of the specimens the external branchial appendages are likewise visible.

3297. A female specimen of a Salamander, with the ventral parietes of the abdomen removed, and the ovaria with both the impregnated oviducts displayed *in situ* ; that on the left side has been laid open, and four of the transversely coiled embryos have been removed, but are preserved in the same bottle ; each oviduct is bent upon itself like the handle of a vase.
3298. The alimentary canal, with part of the liver, the heart, kidneys and impregnated oviducts of a Salamander ; the division of each oviduct into a fallopian or oviducal and an uterine portion is clearly exhibited in this specimen. Bristles have been inserted into the free anterior apertures of the oviducts or fallopian tubes : these apertures are situated anterior to the liver, between it and the pericardium : the oviducts descend parallel to each other, forming short irregular convolutions behind the ovaria, and then turning forwards and outwards, suddenly expand into the uterine tubes : these have thin semi-transparent parietes, and contain each between twenty and thirty foetuses, which are disposed as in the preceding specimens ; some of them have been removed from the right uterus.
3299. A portion of the uterus of a Salamander, with two embryos far advanced in development ; the lower one is inclosed in its membranes ; the upper one is uncovered and uncoiled, it is two-thirds of an inch in length : the abdominal parietes have been removed from this specimen to exhibit the large vitellus which has afforded sustenance to the larva in the passive condition in which it has been developed ; notwithstanding, however, that this has taken place within the body of the parent, and by means of nutriment primordially prepared in the ovum, there may be observed in the foetal Salamanders the principal characteristics of the larva of ordinary Batrachia which obtain their sustenance in water free and independent of the parent,—as, for example, the external branchiæ, the compressed tail,

and the broad, vertical, cutaneous expansions continued from its upper and lower margins, by which it is adapted for the office of a powerful natatory organ: these parts in the Salamander are absorbed soon after birth, and the vertically compressed is converted into a round tail.

3300. A foetal Salamander, with a section of its vitelline sac at an earlier stage of development.

3300 A. A female Salamander (*Salamandra atra*, Cuv.), with one of the two foetuses which it is limited to produce at each season of sexual activity: this foetus is, as might be expected, relatively much larger than those of the previous multiparous species; it is one day old, and exhibits the three fimbriated external branchiæ at one side of the neck, but the tail has lost its vertical natatory folds.

*Presented by the Rev. Dr. Buckland, F.R.S., &c.*

*b.* In Ametabolian Reptiles, in which the young do not undergo a Metamorphosis.

3301. A Snake (*Coluber*, LINN.), with the ventral parietes of the abdomen laid open, to show the mature ovaria *in situ*; they contain a chain of closely-packed ova ripe for impregnation, and retained by an extremely delicate and attenuated capsule. A few small ovisacs are developed in the interspaces of the mature ovarian ova.

3302. A section of the common harmless Snake (*Coluber Natrix*, LINN.), with the ventral parietes of the abdomen removed, to show the impregnated oviducts *in situ*. The abdominal aperture of each oviduct has the form of a wide slit with irregular but not fimbriated margins; that of the right side is situated six inches anterior to the one on the left: the oviduct is at first narrow and disposed in short transverse folds; it is afterwards distended with the ova, which are arranged in a single series somewhat obliquely with respect to each other: they are generally excluded before development of the embryo has begun in this as in most other innocuous species of serpent.

3302 A. A section of the kidney and impregnated oviduct with two ova of the common Snake. The oviduct is supplied by a vessel which runs parallel

with its inner margin, and sends off branches, mostly at a right angle, which ramify in a wavy course upon the parietes of the oviduct. The longitudinal muscular fibres of the duct may be discerned in this preparation.

*Presented by William Lawrence, Esq., F.R.S.*

- 3303. The ovaria, kidneys, rectum, and portions of the oviducts, in one of which are two ova of a smaller Snake; the form, colour, and character of the external surface of the ovum are discernible through the thin and transparent parietes of the oviduct.
- 3304. Several of the ova of the common harmless Snake (*Coluber Natrix*, LINN.) soon after exclusion.
- 3305. A small cluster of the ova of the harmless Snake.
- 3306. Two ova of another species of Snake, in which the dark-grey parchment-like chorion is strengthened by the deposition of a thin layer of white calcareous matter.
- 3307. Several ova of a Snake, of a narrow elliptical form, and having the external membrane marked by fine and slightly waved longitudinal rugæ.
- 3308. A longitudinal section of the chorion or external membrane of the ovum of a Snake, in which the two layers of the chorion are demonstrated.
- 3308 A. The ovum of a Boa Constrictor.

*Presented by William Clift, Esq., F.R.S.*

- 3309. The posterior part of the trunk of a Viper (*Vipera communis*, LEACH), with the ventral parietes of the abdomen removed to show the ovaria *in situ*. These bodies are divided into a series of nine oval saccular compartments succeeding each other lengthwise, and each containing an ovum ready to be received into the oviduct. A bristle is inserted into the abdominal aperture of the left oviduct.
- 3310. The posterior moiety of a Viper (*Vipera communis*, LEACH), with the ventral parietes of the abdomen removed to show the ovaria and oviducts *in situ*; the right oviduct contains five, the left three ova; development has commenced, and the embryo viper with its vascular membranes may be discerned through the thin and semi-transparent oviduct.



3311. The ovaria, kidneys and impregnated oviducts of a Viper; the ova exhibit an earlier stage of development of the embryo.
3312. A longitudinal section of the ovum of a Serpent. It shows the membranes contracted upon some irregular sub-spherical masses of vitelline matter.
3313. Two of the ova of a Serpent in longitudinal section.
3314. The posterior moiety of a Rattle-snake (*Crotalus horridus*, LINN.), dissected to show the ovaria and oviducts *in situ*; a few of the ova in each ovarium have acquired a considerable size, and the ovisacs are apparently ripe for dehiscence: the external capsule of the ovarium is extremely thin, and the stroma is scanty and of a semi-fluid consistence; the whole course of both oviducts is shown, and the terminal dilatation of the one on the right side is laid open.
3315. A portion of the ovarium of a Rattle-snake, with several ova fully formed and ripe for impregnation.
3316. The ovum of a Rattle-snake, with half of the chorion removed, to show the embryo snake disposed in four spiral coils in a cavity on one side of the vitellus.
3317. The ovum of a Serpent, from one half of which the chorion has been removed to show the embryo, far advanced in development, imbedded in the cavity of the vitellus, and inclosed, with the vitellus, in a duplicature of the allantois, which has been lacerated opposite the head of the embryo.
3318. A fœtal Snake, with the vitelline sac and a portion of the allantois attached to it by the trunks of the allantoic or umbilical arteries and veins; the vitelline mass is divided into many lobes.
3319. A fœtal Snake further advanced in its development, and the vitelline sac proportionally reduced in size, and now appended to the side of the coiled-up embryo.
3320. The ovum of a Snake, from which half of the chorion has been removed to show the young snake at the completion of its development.

3321. An embryo Snake, with its appended vitellicle, the duct of which presents considerable length and tenuity; it passes into the abdomen at about the commencement of the posterior third of that cavity; the two membranous sacciform organs of intromission are everted, and project from the sides of the cloaca.
3322. An embryo Snake, at about the same period of development, with the abdominal cavity laid open and its different viscera exposed *in situ*; the continuation of the ductus vitello-intestinalis through the cavity of the cotyloid yelk-bag is here clearly shown.
3323. A female embryo Snake, at a similar period of development, with its appended cup-shaped vitellicle.
3324. An embryo Snake, far advanced in development, showing the communication of its umbilical cord and vitelline duct with the cup-shaped vitellicle, in the cavity of which the young snake lies spirally coiled during the progress of its development. Impressions of the scutæ of the young snake are left upon that part of the membrana vitelli with which it was in contact; in this, as in the specimens Nos. 3221 and 3222, the two penes are everted.
3325. A Slow-worm (*Anguis fragilis*, LINN.), with the ventral parietes of the abdomen removed and the viscera displayed in their natural relative position; the parts more particularly intended to be shown are the impregnated oviducts, which are symmetrically situated with respect to each other, and contain each seven or eight ova arranged in a linear series.
3326. A similar preparation, in which the development of the young Slow-worms in the impregnated oviducts is nearly completed; three of the embryos of this viviparous snake have been removed from the oviduct, and may be seen at the bottom of the bottle. The development of the young of the slow-worm, as of the viper, takes place without any placental formation or adhesion between the membranes of the foetus and parent: the large quantity of vitellus is the apparent compensation for the absence of that medium of transmitting the nutriment to the embryo.

3327. A Chameleon (*Chameleo Senegalensis*, Cuv.), with the ventral parietes of the abdomen removed and the viscera exposed *in situ*, principally to show the ovaria and oviducts; the ovarian ova are of equal size, presenting a diameter of between four and five lines, and are closely impacted in alternate linear series; the capsule of the ovarium is thin and transparent; the stroma is scanty, and of an extremely delicate consistence; the oviducts are disposed in irregularly compressed folds.
3328. The ovaria and oviducts, with the kidneys and liver of a Chameleon: the ovaria are laden with mature ova, similar in number, form and size to those of the preceding specimen, but somewhat less regularly arranged: one of the ova has been removed from the ovisac; a section of another has been made to show the deep yellow colour of the vitellus.
3329. One of the ovaria of a Chameleon laden with ova ripe for impregnation.
3330. One of the ovaria, with a portion of the corresponding oviduct of an Iguana; most of the ovarian ova have obtained the diameter of from four to six lines; they are impacted in an irregular manner, with smaller ovisacs and ova in their interspaces: a bristle is inserted into the elongated narrow abdominal aperture of the oviduct, which is connected with the ovarium by a broad mesometry.
3331. The ovarium of a Lacertian Reptile, in which about thirty ova are in progress of development for impregnation; they are of a spherical form, and have attained a diameter of two lines; the small transparent germinal vesicle may be seen in some of the ova in the superficies of the vitellus.
3332. A Gecko Lizard (*Thecadactylus levis*, Cuv.), with the ventral parietes of the abdomen and most of the abdominal viscera removed. Two ova only appear in this Saurian to be impregnated and developed at each season of generation: one of these ova is exhibited *in situ*; the other has been removed from the dilated portion of the oviduct in which it was situated: bristles are inserted into the cloacal apertures of each oviduct.
3333. A specimen of the *Thecadactylus levis*, with the abdominal viscera exposed *in situ*, more especially to show the ovum on the left side, and a



section of that on the right side ; there is no trace of embryonic development visible in either of these specimens.

- 3333 A. Another species of the Gecko Lizard, with the two ova which it has recently excluded. *Presented by Hugh Cuming, Esq.*
3334. A Lizard (*Anolius*, Cuv.), with the ventral parietes of the abdomen removed to show the viscera *in situ*, and more especially the oviducts, each of which contains a single large elliptical ovum.
3335. A similar specimen, in which a longitudinal section has been removed from the oviduct and its contained ovum, showing the large size of the vitelline mass in the latter.
3336. Two specimens of *Anolius*, similarly dissected to show the oviducts, one of which contains a single large ovum in each specimen.
3337. A Lizard (*Ameiva lemniscata*, Cuv.), with the abdomen laid open to expose the oviducts, each of which contains two large elliptical ova.
3338. An allied species of *Ameiva*, with the abdomen laid open, and a single large ovum exposed, part of which has been dissected away.
3339. A Skink Lizard (*Tiliqua*), with the ventral parietes of the abdomen dissected off to expose the impregnated oviducts ; they contain each from six to eight ova, of an elliptical form, and nine lines in the long diameter : development of the embryo has commenced in each ovum, as is evinced by the large size of the transparent area on the surface of the vitellus.
3340. A specimen of the same species of Skink ; the right oviduct is laid open, showing two of the young completely developed ; those of the opposite oviduct appear to have been excluded.
3341. A Lizard (*Lacerta bilineata*, Cuv.), dissected to display the female organs of generation, and especially the ovaria, which contain ova ripe for impregnation and dehiscence. [Compare this specimen with No. 2712, which exhibits the ovaria of the same species in the quiescent state.]
3342. A similar specimen.

3343. A Lizard (*Lacerta quadrilineata*), dissected to display the ovaria and oviducts *in situ*; several of the ovarian ova have nearly reached their mature development; the oviducts present a corresponding enlargement, and are disposed in numerous short transverse folds; this is best shown in the right oviduct, in the termination of which a bristle is inserted.
3344. A similar specimen, with many of the ovarian ova ripe for impregnation.
3345. A Lizard (*Tropidolepis undulatus*, DUM.), with part of the ventral parietes of the abdomen removed, to show the ovaria with mature ova in their natural relative position.
3346. The viviparous Lizard (*Podarcis muralis*, WAGLER), with the ventral parietes of the abdomen removed, to show the impregnated oviducts; the right is *in situ*, and contains three ova, in each of which the development of the embryo has considerably advanced; the left oviduct has been displaced and turned forwards; one ovum and the vitelline sac of a second have been removed.
3347. Another specimen of the viviparous Lizard, with four of her newly excluded young.
3348. The ovum of a Lizard, laid open to show the embryo far advanced in development; also an embryo removed from another ovum of the same species of Lizard at a similar stage of development; the beak-shaped edentulous mouth, large eyes, and equal-sized cerebral hemispheres and optic lobes merit notice in this specimen.
3349. The embryo of a Lizard far advanced in development, with the umbilical cord and vitelline sac; the latter has been laid open and its contents removed: there is no appearance of the vascular plicæ on its inner or mucous surface analogous to the so-called 'vasa lutea' in the bird.
3350. A Lizard, removed from the ovum at near the completion of foetal development.
3351. The right ovarium and oviduct, with the corresponding kidney, ureter, urinary bladder and cloaca of a Turtle (*Chelonia Mydas*, BRONGN.): the ovary presents the form of a thin ribbon-shape fold of membrane with a

- minutely granulated surface, produced by the commencing development of the ovisacs and ova.
3352. A portion of the ovarium of a Turtle injected, with a few of the ova farther advanced in their formation.
3353. A similar preparation: it exhibits well the broad duplicature of peritoneum which supports the ovarium.
3354. A portion of the oviduct of a Turtle containing two ova.
3355. Two of the spherical ova of a Turtle after exclusion preserved in spirit.
3356. Two of the ova of a Turtle after exclusion preserved dry, exhibiting better their external calcareous covering.
3357. Two embryo Turtles, each about an inch in length, showing the commencing growth of the ribs to form the carapace; the branchial fissure at the base of the neck is widely open.
3358. A young Turtle, with the ventral parietes of the abdomen removed to show the small vitelline sac appended to the intestinal canal.
3359. The heart, lungs, and principal vessels of a young Turtle, prepared to show the short communicating vessels between the left pulmonary artery and left descending aorta, and between the right pulmonary artery and right descending aorta; these are subsequently obliterated; the third intercommunicating channel between the right and left descending aortæ remains; the general form of the heart and the transmission of the arteries from the left aortic trunk for the left anterior extremities are the same as in the mature animal.
3360. The stomach and intestines of a young Turtle, exhibiting the remains of the two great foetal appendages, viz. the nutritive or vitelline sac, which communicates with the small intestine at about one-fourth of the length of the intestinal tube, measuring from the stomach, and the respiratory or allantoid vesicle communicating with the termination of the rectum.
3361. A portion of the ovarium of a Tortoise (*Testudo*, BRONGN.), injected, with several of the ova in an advanced state of formation.
3362. One of the spherical ova of a Tortoise, removed from the termination of



the oviduct, and showing the commencing deposition of the external calcareous crust.

- 3363. Three Tortoises of different ages, showing the progressive obliteration of the external umbilical aperture: this is seen in the upper and smallest specimen at the convergence of the angles of the fourth, fifth, and posterior pairs of plates or scutæ of the plastron; in the lower and largest specimen it is reduced to the form of a narrow longitudinal fissure at the interspace of the fifth pair of plates.
- 3364. Two eggs of a Crocodile; in the lower one, part of the crust is torn away to show the 'membrana putaminis,' in the upper specimen half the egg-shell with the contiguous membrane has been removed to show the young crocodile at the completion of its development.
- 3365. A young Crocodile removed from its ovum, which remains attached to it by the umbilical cord and the vessels of the allantoic membrane; a section of the ventral parietes of the abdomen has been turned aside to show the portion of the vitelline sac which has been taken into the abdomen.
- 3366. The posterior half of a young Crocodile, dissected to show the condition of the vitelline and allantoic sacs at the close of foetal development: the vitelline sac presents an irregular lobated form, and its short and narrow duct communicates with the small intestine a little below the duodenum; the allantois communicates with the lower part of the rectum by means of a longer and very slender duct analogous to the urachus, but no part of which is dilated to form the urinary bladder; the hypogastric or umbilical arteries and the corresponding veins are likewise shown.
- 3367. A young Crocodile, with the ventral parietes of the abdomen removed to show the remains of the vitelline sac in the abdominal cavity; the pericardium is laid open, and a longitudinal section has been removed from the right aorta and ventricle; the cavity in the latter is extremely small as compared with its muscular walls.
- 3368. The thoracic-abdominal viscera of a foetal Crocodile, prepared to show the heart with its principal vessels, and especially the two long 'ductus

arteriosi' communicating with the two persistent aortæ; a black bristle is placed behind one of these transitory canals, a white bristle shows the termination of the other: a section is removed from the vitellaricle, and a bristle inserted into the short duct of that sac.

- 3369. The stomach and intestines of a young Crocodile, together with that part of the ventral parietes of the abdomen which forms the umbilical aperture, showing the transit of the yelk into the abdomen, one half of which has passed through the wide aperture.
- 3370. The stomach and intestinal canal of a young Crocodile at a later period of growth, with the vitelline sac, which has been wholly taken into the abdomen, and has been much reduced in size by absorption of its contents: a section has been removed from it to show the hard, coagulated, and fibrous character of the remaining yelk.
- 3371. A similar preparation, with the contracted vitelline sac entire.
- 3372. The thoracic-abdominal viscera of a foetal Crocodile, with the vitelline sac and its contents in great part removed, and the aperture leading to the vitelline duct displayed and a bristle inserted into it: a number of fine vascular folds radiate from this aperture, representing the so-called 'vasa lutea' in the fowl; a bristle is likewise inserted into the still open duct of the allantois.
- 3373. The heart with part of the œsophagus and one of the lungs of a foetal Crocodile; each auricle is laid open, and their septum exposed with the still patent narrow 'foramen ovale': bristles are inserted into the different primary branches of the two aortæ, and likewise into one of the ductus arteriosi.
- 3374. The cloaca of a young Crocodile, laid open to show the single-grooved penis.

#### SERIES XIV. In Birds.

- 3375. A House-Sparrow (*Pyrgita domestica*, Cuv.), with the ventral parietes of the abdomen and all the viscera excepting the generative and urinary organs removed; the single ovarium, which here, as in other birds, is

the one on the left side of the body, presents a racemose figure, in consequence of the small quantity of stroma and the great accumulation of vitellus about the essential parts of the ovum ; the ovarium has, however, only begun to take on the stimulus of sexual development ; the single oviduct is proportionally small.

3376. A House-Sparrow similarly prepared, exhibiting the female organs in the state of their full functional activity ; the large size of the ovarium is occasioned by the great development of a few of the ova ; of these, two were probably destined for dehiscence, and two have already escaped from the ovisacs or calices ; one of these is contained in the oviduct, and has traversed about one-third of that tube ; it is reflected downwards from the abdominal cavity, and a bristle is inserted into the abdominal or ovarian aperture.

3376 A. The posterior half of a Cuckoo (*Cuculus canorus*, LINN.), showing the left ovarium and oviduct at the period of full functional activity ; two of the ovisacs exhibit those dimensions which indicate that they are destined for dehiscence ; one presents the diameter of about six, the other of about three lines : one ovum has already been received into the oviduct, and has reached the terminal uterine or calcifying segment ; a portion of the shelly secretion is detached, showing the membrana putaminis.

*Prepared by Dr. Jenner.*

3376 B. A similar preparation of a Cuckoo, exhibiting the parts of generation soon after the close of their functional activity ; four ova have been matured and impregnated, and the empty pedicellated calices or ovisacs are left behind : the oviduct still presents a large size, and is disposed in broad, irregular and transverse folds ; the proportions which the ovarian ova present, as compared with that which has passed into the oviduct, so nearly resemble those of the Sparrow as to afford no aid in the elucidation of the peculiar parasitic habits of this bird.

*Prepared by Dr. Jenner.*

3377. The egg of a Cuckoo towards the close of its parasitic incubation, with part of the shell broken away to expose the contained embryo.



3378. The left ovary of a Hen, showing the ovisacs in different stages of formation, and a few emptied and collapsed after the escape of the ovum.
3379. The left ovary of a Hen, with contiguous portions of the vena cava and aorta, together with two of the emptied ovisacs or calices.
3380. The female organs, rectum and cloaca of a Hen; the ovary exhibits the ovisacs and ova as usual in different stages of formation, one of the ova being nearly ripe for dehiscence. Different parts of the large plicated oviduct are laid open, showing the parallel longitudinal irregular wavy folds of the lining membrane; the oviduct is attached on one side to the mesometry; on the outer and anterior side the radiated ligament which contains contractile fibres is shown; the openings of the rectum and oviduct in the urinogenital part of the cloaca are also exposed.
3381. The trunk of a common Fowl, with the anterior parietes of the chest and abdomen laid open, and the viscera removed so as to display the female generative organs *in situ*. The ovary exhibits three vacated ovisacs, the analogues of the so-called 'corpora lutea' in the Mammalia; the aperture by which the ovum has escaped is in the form of a long fissure, with thin but not everted margins; these ovisacs having performed their functions, are afterwards disposed of by progressive absorption. The other ovisacs, as usual, present ova in different stages of formation. The parts have been minutely injected, so that the non-vascular line or 'stigma', towards which the capillaries of the ovisac converge, and at which dehiscence takes place, is very clearly displayed. A bristle is inserted into the wide ovarian aperture of the oviduct; its capacity is proportioned to the magnitude of the ovarian ovum which it is destined to receive; its margins are thin, semi-transparent and entire: an ovum has passed into the uterine or calcifying terminal segment of the oviduct, and is there exposed by the reflection of part of the parietes of that cavity, which at the same time displays the multiplication of the surface of the secreting membrane, by its disposition into close-set, complex, wavy folds: this membrane is highly vascular.
3382. The impregnated oviduct of a Hen, uninjected, with an ovum exposed, as in the preceding specimen, by reflection of part of the parietes of the ute-

rine segment: the contractile fibres of the radiated ligament are beautifully exhibited in this specimen.

3383. The uterine or calcifying segment of the cloaca of a Duck (*Anas Boschas*, LINN.), having a contained ovum similarly exposed by the reflection of part of the parietes of the cavity; the particles of the shell are beginning to be deposited upon the membrana putaminis, and their arrangement may be discerned by the aid of a pocket-lens.
3384. The ovarium and oviduct of a Goose (*Anser palustris*, Cuv.), with the kidneys and cloaca, all minutely injected with size and vermilion; the ovisacs and ova are in various stages of formation; the structure of the vacated ovisacs, and the stigma in those that contain the ovarian ova, are beautifully displayed. The terminal calcifying segment of the oviduct is laid open by a crucial incision, and a piece of quill is passed through the contracted aperture by which it communicates with the narrower part of the tube that secretes the albuminous part of the egg.
3385. The ovarium of an Ostrich (*Struthio Camelus*, LINN.), at the period of sexual excitement, exhibiting the ovisacs and ova in very different stages of formation: they are remarkable for the density of their parietes and the length of their pedicles.
3386. The egg of a Goose, broken transversely and the contents removed, showing the shell and the chorion or 'membrana putaminis'.
3387. A transverse section of the large end of the egg of a Goose, showing the natural separation of two of the layers of the membrana putaminis, forming the 'vesica aëris'; the gaseous contents of this receptacle contain a larger proportion of oxygen than common air.
3388. Another section of the egg of the Goose, showing half of the 'vesica aëris'; the layer of membrane forming the internal wall of this cavity is thinner than the outer layer, from which it can be separated through the whole extent of the egg.
3389. A Hen's egg, from which a longitudinal section has been removed, to show two unequal-sized yolks, which, having passed at or near the same time into the oviduct, have become surrounded by a common investment of the albuminous secretion of that tube, and finally by a common shell.

[The following sixteen preparations exhibit the earlier stages in the progressive development of the embryo of the Goose, the parts being disposed for examination by reflected light. The Manuscript Catalogue contains no notes of the periods of incubation at which the embryos were successively removed. There are original Hunterian drawings of some of these specimens, or of embryos at analogous stages of development: of these, likewise, the College possesses no descriptions by Mr. Hunter, but they are alluded to in the general account of the development of the Chick, given in the Introduction to the present volume of the Physiological Catalogue. From the extreme delicacy of the tissues of these embryonic subjects, some of them no longer exhibit the appearances which they were prepared to show upwards of half a century ago.]

3390. The cicatricula, or centre of embryonic development, of an impregnated egg.

3391. A portion of the germinal membrane, showing the circular 'area opaca,' and the clear central space, or 'area pellucida,' into which the linear embryonic trace, 'gleba centralis,' extends: in this preparation may be observed, by aid of a lens, the first division of the linear trace into two lateral columns, which are the rudiments of the spinal chord.

The appearances here presented correspond with those of the germinal membrane of the chick at the fifteenth hour of incubation.

3392. The germinal membrane, at probably a later period of development: the exact position of the embryonic trace cannot be satisfactorily discerned in this preparation.

3393. A circular portion of the germinal membrane, including the area opaca, the area pellucida, and the longitudinal embryonic trace, at the twentieth hour of development; the two lateral columns of the medulla spinalis, and the bending downwards of their cephalic extremities into the substance of the yolk, may here be discerned, by aid of a slight magnifying power, with beautiful distinctness: the transverse crescentic fold of the serous layer of the germinal membrane, occasioned by this inflection of the embryo, may be distinguished, from its superior opacity, by the naked eye; the slight divergence of the caudal extremities of the lateral columns



of the spinal marrow, with the general outline of the abdominal portion of the embryo formed by the *laminæ ventrales*, may be traced upon the *area pellucida*, the centre of which is occupied by the embryo.

3394. A section of the germinal membrane, including the *area opaca*, the *area pellucida*, and the embryo, of which the ventral surface, or that next the *vitellus*, is here exposed. The horns of the transverse crescentic fold, of which the first formation was shown in the preceding preparation, may be seen descending towards the caudal extremity of the embryo; the opaque, elongated body observable in the cephalic concentric folds, is the *punctum saliens*, or first rudiment of the heart; the spinal medullary columns, their caudal dilatation, and the outline of the trunk of the embryo, though faint, are more distinct than in the preceding specimen. The opaque area of the germinal membrane is increased, and now a portion nearest the transparent area begins to be defined by the formation of clear spaces forming the sinuses, in which the circulating fluid, as yet colourless, is accumulating. These sinuses are situated in the *area vasculosa*, which has begun to increase in extent. The appearances here presented correspond with those of the germinal membrane of the chick at the middle of the second day of incubation.

3395. A section of the germinal membrane, including the *area opaca*, the *area pellucida*, and the embryo; the inner zone of the *area opaca* is here clearly defined, and its circumference is marked by a series of small sinuses, which form the boundary of the vitelline circulation; traces of the vascular canals which pass from these sinuses through the inner zone and the *area pellucida*, in their converging course towards the *punctum saliens*, are visible with the aid of a pocket-lens. The dorsal surface of the embryo, which has now risen from the surface of the germinal membrane, is here exposed; the head, of which the commencement was shown in a previous preparation, by an expansion of the corresponding extremities of the medullary cords, is readily recognisable: it has been slightly raised from the depression in the substance of the yolk formed by its bending towards that part; and this depression, being lined by the same serous membrane which originally covered the peripheral surface of the

germinal membrane, offers now the first stage in the formation of the amnios. The two cords of the medulla spinalis are very distinct; the opaque line external to and parallel to their posterior extremities, is due to the commencement of a fold of the mucous layer of the germinal membrane, which constitutes the 'fovea analis' in the formation of the intestinal canal. The nuclei of the vertebræ are not distinguishable in this specimen, which is about two lines in length. The appearances here observable correspond with those of the germinal field of the chick at the close of the second day of incubation.

3396. A similar section of the germinal membrane and embryo, at a later period of development, seen from the dorsal aspect. The small receptacles or lakes of the circulating blood have now coalesced, to form the circular sinus which bounds the inner zone of the area opaca, immediately surrounding the area transparenens; the vascular canals, continued from this sinus, may be observed converging towards the umbilical region of the embryo, and there constituting the transverse omphalo-mesenteric veins: they are thence continued in a direction parallel to the axis of the embryo, but slightly converging to the rudiment of the heart, which here may be distinctly seen in the form of a bent canal beneath the inflected cephalic extremity of the embryo: the head is slightly bent to the right side; in it may now be seen the large ophthalmic globe or vesicle and the olfactory prominences; the vertebral nuclei may be discerned by means of a pocket-lens on each side of the medullary cords; the outline of the intestinal laminæ, and the opaque caudal capsule of the medulla spinalis, are very clearly shown in this preparation. The appearances here presented correspond with those of the chick at the early part of the third day of incubation.

3397. A similar preparation, with the embryo at a more advanced stage of development, and exhibiting more clearly the particulars noticed in the preceding preparation: the amniotic sheath, of which the first commencement was noticed in the description of Nos. 3393, 3394 and 3395, is now reflected over the anterior half of the embryo: the zonular sinus is completely formed, and the vitelline circulation fully established; the trunks

and ramifications of the transverse omphalo-mesenteric veins are very distinct, but the corresponding arteries can hardly be discerned without the aid of a lens; the two superior longitudinal veins, which return the blood from the upper part of the zonular sinus where it bends down towards the embryo, are now developed; the one on the left side may be traced to the tubular heart, entering the auricular division of the tube, close to the termination of the ascending trunks of the transverse veins; it is persistent, and forms the superior left vena cava, which is found in all birds. The first commencement of the three successive divisions or dilatations of the bent cardiac tube may be here discerned. The state of the development of this embryo corresponds with that of the chick at the latter part of the third day of incubation.

3398. A similar preparation, at a little more advanced stage of development, in which all the parts mentioned in the preceding description are more clearly discernible, and especially the primitive divisions of the brain, the vesicles forming the rudiments of the eye and ear, and the auricular, ventricular and aortic dilatations of the heart. Only the posterior extremity of the embryo is now uninclosed by the amnios, which sac still remains open at that part on the dorsal aspect.
3399. A similar preparation, at a more advanced stage of development: in the head of this specimen, the olfactory prolongations, the opaque eye-balls, the clear acoustic vesicles, and, above these, the three principal cerebral enlargements, forming respectively, as they succeed each other from before backwards, the cerebrum, optic lobes, and medulla oblongata, may be very clearly discerned. The vascular membrane, organized by the omphalo-mesenteric vessels, has increased in size; it is co-extended with the mucous layer of the germinal membrane immediately over the yolk; the distinction of area opaca and area pellucida begins now to be obliterated: the embryo is about four lines in length, but as yet there are no traces of locomotive extremities or of an allantois. The digestive sac still retains a single aperture towards the vitellus; it terminates above in the 'fovea cardiaca,' and below in the 'fovea analis.'
3400. The embryo, with a portion of the vitelline membrane, at a more advanced



stage of development. The rudiments of wings and legs may now be observed in the form of small and simple tubercles; the anterior part of the trunk, as well as the head, is bent to the right side; the different parts of the embryo noticed in the preceding preparations may now be clearly recognised in this specimen: as the dorsal aspect is next the observer, the rudiment of the allantois, which begins to make its appearance about this time, cannot be seen. The progress of the embryo corresponds with that of the chick at the close of the third day of incubation.

3401. An embryo, with part of the vitelline membrane, at a later stage of development: it is seen from the inferior or ventral aspect, in which view the transverse arteries of the vitelline sac are distinctly shown coming off from the aorta, whilst the corresponding veins are still more clearly discernible, and their communication with the longitudinal veins, and their termination in the auricular segment of the heart are very plainly demonstrated; the contraction between the auricle and ventricle of the heart is well marked, and the ventricle is now characterized by its darker colour. A faint trace of the pellucid area is still visible opposite the cephalic extremity of the embryo; the amniotic sac is now completed, and invests every part of the embryo save those which are still open towards the vitellus: the sheath inclosing the posterior termination of the spinal marrow forms the 'involucrum caudæ' of Wolff; this sheath contains the rectum, around which the pelvis is beginning to be developed: the cephalic extremity of the embryo is now so far inflected that the occiput is turned forwards, and the sinciput towards the heart: the folds of the mucous layer in the region of the neck, near the concavity of this inflection, the interspaces of which have been described as the branchial fissures by Rathké, are here visible, but the branches of the aorta corresponding with these folds cannot be discerned. The sides of the open abdominal fissure, from the heart to the rudimental pelvis, are occupied by the transitory renal glands, called 'corpora Wolffiana,' and the allantoic sac, which receives their secretion, and is destined to still more important functions in the œconomy of the egg, is beginning to be expanded as a simple cæcal process from the anterior part of the rectum.

3402. An embryo, with the vascular layer of the vitelline sac farther advanced in development, seen from the dorsal aspect. The allantois now presents itself in the form of a translucent vesicle protruding beyond the margin of the 'involucrum caudæ': the rudiments of the most important structures of the head are here beautifully distinct; as, *e.g.*, the nasal and maxillary protuberances anterior to the cerebral lobes, the simple eye-balls, which have been developed from the optic lobes, and the ear capsules, which form the lateral appendages to the medulla oblongata.
3403. An embryo, with the pellucid allantois expanding beyond the boundaries of the abdominal cavity into the space between the true and false amnios, and acquiring an investment from the latter membrane, which is a continuation of the serous layer of the blastoderm. The rudimental legs and wings have increased in size, and all the parts which have been noticed in the preceding preparations are more conspicuous, and may be more easily studied in the present one, which corresponds with the condition of the chick at the fourth day of incubation.
3404. An embryo, with the allantoid vesicle farther developed; some remnants only of the vitelline sac are here preserved: the vesicular structure of the principal cerebral masses is beautifully demonstrated in this preparation; the crystalline lens is conspicuous from its opacity in the centre of the projecting part of the eyeball.
- The stage of development here displayed corresponds with that of the chick at the fifth day of incubation.
3405. An embryo, farther advanced in development, with a great part of the vitellicle and the allantois, which now forms a flattened sac one inch in diameter: the hypogastric vessels ramifying on the vascular layer of this sac are now distinctly visible; the amnios and the continuation of the serous layer of the germinal membrane which the allantois is carrying before it are shown; some opaque particles of the secretion of the Wolffian bodies may be discerned in the allantois: the locomotive extremities begin to exhibit their divisions into distinct segments or joints: the aperture of communication between the intestinal cavity and the yolk is now con-

tracted into the form of a short and wide duct, called the 'ductus vitello-intestinalis.' The stage of development here exhibited corresponds with that of the chick at the sixth day of incubation.

[The following fourteen preparations illustrate similar changes in the development of the Chick, and are so disposed that they can be examined by transmitted light.]

- 3406. This preparation shows the stage of the development of the embryo corresponding with that of 3391, viz. the opaque and pellucid area of the germinal membrane, and the 'nucleus' or embryonic rudiment in the centre of the latter, and parallel with its long axis.
- 3407. This preparation probably exhibited a succeeding stage in the development of the embryo, but its condition does not admit of accurate description.
- 3408. The germinal membrane, exhibiting a slightly advanced stage of development, but the distinction of parts is obscure.
- 3409. The germinal membrane and embryo at the same period of development as No. 3393: the increase of the opaque area, and the well-defined pellucid area may here be seen: the halones are indicated in the opaque area by sub-transparent spots, which indicate the first stages in the development of the nutrient fluid; in the area pellucida the lateral cords of the medulla spinalis are distinctly confluent at both extremities; the cephalic end has begun to enlarge, and is nearly in contact with the opaque area.
- 3410. The germinal membrane and embryo farther advanced: the lateral cords of the spinal column are distinctly shown; the cephalic extremity is inclosed in its amniotic sheath; the fissure between the cerebral hemispheres is very manifest. When viewed from the ventral aspect, ten pairs of vertebral nuclei may be counted; the punctum saliens presents the form of an oblong opaque body, partly contained in the cephalic sheath anterior to the medulla spinalis; the inferior or transverse fold of the serous or amniotic membrane may be clearly discerned.
- 3411. A similar preparation, at a more advanced period of development. Fifteen



pairs of vertebral nuclei are here apparent: the three successive cerebral dilatations may be distinguished, and the cleft dividing the anterior or cerebral pair is obliterated or obscured by the opacity of the capsular covering. The lower orifice of the cephalic amniotic sac is very obvious from the ventral aspect, and the two cornua of the transverse concentric folds appear to contain vessels, each forming the point of convergence of a radiated series of opaque cells continued from the halones; the spinal marrow from this aspect appears to be sunk in a fissure and not to be inclosed. The appearances presented by this preparation correspond with those of the chick at the thirty-sixth hour of incubation.

- 3412. The germinal membrane somewhat farther advanced in development, being at the period corresponding with that of No. 3396.
- 3413. A similar preparation.
- 3414. In this preparation may be observed the extension of the amniotic sheath over the anterior half of the embryo, and the crescentic fold with which it terminates, and which has its concavity directed towards the caudal extremity of the embryo. The condition of this, as of the other parts of the embryo, corresponds with that of the specimen No. 3397.
- 3415. The amniotic sheath now invests the whole of the dorsal and lateral aspects of the embryo. The division of the aortic trunk may here be observed, with the origin of the two transverse vitelline or omphalomesenteric arteries; the left superior cava is very distinctly shown, together with the division of the heart into the auricle, ventricle, and bulbus arteriosus, succeeding each other in a sigmoid curve. The different parts previously noticed in the embryonic head may be well studied in this preparation, as, for example, the cerebrum and olfactory prolongations, the optic lobes and eyes, and the medulla oblongata, with the appended vesicles forming the rudiments of the acoustic labyrinth: the opaque white mass at the extremity of the spinal cord is the rudiment of the pelvis: the pellucid area is still well defined.
- 3416. In this preparation, the vascular system, which carries on the circulation between the embryo and vitelline sac, may be seen to be fully established. The vascular layer of the germinal membrane is rapidly expanding over

the yolk ; its cordiform figure, arising from the bending in of the cephalic part of the zonular sinus, is now very perceptible : the transverse omphalo-mesenteric arteries may be distinguished from the corresponding veins : the superior and inferior longitudinal veins are also clearly manifest : the boundary of the pellucid area is now nearly obliterated. The stage of development here exhibited corresponds with that of the preparation No. 3399.

- 3417. The embryo and germinal membrane, exhibiting a stage of development intermediate between those of Nos. 3401 and 3402. The allantois, in the form of a pellucid vesicle, occupies the space between the rudimentary pelvis and the heart ; the nascent wings and legs exhibit the form of obtuse undivided processes : the Wolffian body of the right side may be seen projecting beyond the margin of the still open abdominal cavity, in the interspace of the anterior and posterior extremity : all the parts of the head, and the vessels of the vitelline circulation noticed in the preceding, may be more clearly discerned in the present one.
- 3418. An embryo, with the germinal membrane of somewhat larger size, but exhibiting the same stage of development as the preceding specimen.
- 3419. An embryo, with a portion of the germinal membrane, showing the progressive expansion of the allantois, which now protrudes beyond the abdominal fossa ; the ramifications of the hypogastric vessels may be discerned upon it : the mucous folds at the anterior part of the neck, and their interspaces or branchial fissures, may be very plainly seen in this specimen. The appearances here presented correspond with those of the chick at the sixth day of incubation, when it lies immediately beneath the shell.
- 3420. An embryo, with part of its appended membranes, farther advanced in development. The different segments of the extremities are now completed : the formation of the membrana nictitans has begun at the corner of the eyeball : the hollow cerebral hemispheres are laid open.
- 3421. The viscera of the thoracic-abdominal cavity of an embryo Gosling, with a portion of the vitelliculum and allantois attached by their respective ducts to the intestinal canal : the preparation is suspended by the

heart, which is reflected upwards from between the lobes of the liver, to show the deep posterior fissure dividing the right from the left ventricle, and rendering the apex of the heart bifid: the trachea has separated itself from the œsophagus, and the rudimental lungs may be observed above and behind the liver and on each side the descending aorta; they are simple spongy sacs, not equalling a line in length: beneath the left lobe of the liver may be seen the stomach, the division into proventriculus and gizzard being already indicated: below the liver and stomach are the two large transitory kidneys or 'Wolffian bodies:' the abdominal air-cells are not yet developed: the persistent kidneys present the form of long, narrow, elongated, white bodies at the posterior margins of the temporary organs which they are destined to replace: the characteristic distribution of the hypogastric vessels upon the allantois is beautifully seen in the part of that membrane which is here preserved. The condition of the parts here described corresponds with that of the chick at the beginning of the seventh day of incubation.

3422. A similar preparation from an embryo Gosling at a more advanced stage of development; the larger size of all the parts in this specimen facilitates the recognition and study of the same parts in the previous one. The apex of the heart is now entire, being formed by the disproportionate longitudinal development of the left ventricle, which projects beyond the right. A small and simple air-cell begins to be expanded from the inferior margin of the lung. The pancreas may be observed in the interspace of the duodenal fold of the intestine: the convolutions of the jejunum and ileum have increased in number. The gall-bladder is developed beneath the liver.

3423. The corresponding parts of an embryo Gosling farther advanced in development; a longitudinal section has been removed from the right lung, showing its spongy texture; the abdominal air-cell continued from the left lung is very conspicuous between the proventriculus and renal body; it hangs freely among the abdominal viscera, like the receptacular part of the lung of a reptile: the long 'ductus arteriosus', passing now from the pulmonary artery to the descending aorta, may be seen in the poste-



rior interspace of the lung ; the complication of the intestinal canal proceeds by the increase of its ordinary convolutions and the lengthening of the two cæca. The wavy irregular folds of the mucous membrane of the vitellicle are well displayed in this preparation.

3424. A similar preparation of an embryo Gosling at a more advanced period of development. Besides the farther increase of all the parts noticed in the three preceding preparations, there may here be observed the great expansion of the abdominal air-cells: these, however, still present on each side the form of simple uncompressed and undivided sacs, which are freely suspended in the abdominal cavity, and are invested by a duplicature of the peritoneum, without adhering to the adjoining viscera. The junction of the omphalo-mesenteric vein with the inferior cava at the interspace of the kidneys is here well shown. The presence and length of the right oviduct likewise deserves notice.
3425. A similar preparation, from a foetal Gosling at the latter period of incubation; it principally shows the peculiarities of the circulating system at this period, viz. the two ductus arteriosi, one continued from the left branch of the pulmonary artery, the other, and smaller, from the right branch of the same vessel. A slender bristle is placed around both of these temporary sanguiferous canals. The large umbilical or allantoic vein is shown passing above the fissure of the liver to join the short common trunk of the hepatic veins: one of the umbilical arteries is likewise preserved. The vitelline or omphalo-mesenteric vein is seen communicating with the trunk of the inferior cava beneath the liver; the omphalo-mesenteric artery is likewise shown. The stomach and intestinal canal have been removed, together with the lungs and right lobe of the liver.
3426. A foetal Gosling towards the conclusion of incubation, with the right parietes of the abdomen removed to show the course of the allantoic or umbilical vein through that cavity. A red injection has been thrown into the foetus by this vein, which extends from the umbilicus along the right side of the gizzard, between the two lobes of the liver, and anterior or above the isthmus which joins them, to the short and wide trunk of

the inferior vena cava, where it receives the hepatic veins. The right lobe of the liver has been removed: the right auricle is laid open: the intestinal canal, the loop of small intestine to which the vitellicle is attached, and the vitelline vein are likewise displayed.

3427. A foetal Gosling near the conclusion of incubation, injected by the umbilical or allantoic vein, the course of which is shown as in the preceding preparation: the vitellicle is laid open near the junction of the small pedicle or 'ductus vitello-intestinalis,' by which it is attached to the intestine: a bristle is placed behind this duct: the termination of the rectum is laid open to show the communication of this part of the intestinal canal with the allantois, into the duct of which a bristle has been inserted.
3428. A foetal Gosling, with the vitellicle and allantois minutely injected: the vitellicle is laid open, and yields a rich display of the wavy folds of its mucous membrane, called 'vasa lutea' by Haller; the remnant of the thickened albumen is connected to the vitellicle by a continuation of the serous 'membrana albuminis,' and is closely attached to the circular area or boundary of the vitelline circulation, which incloses the aperture by which the albumen is finally received into the vitellicle. The umbilical vessels are seen proceeding to the vascular and respiratory portion of the allantois, which is suspended below the vitellicle.
3429. An embryo Duck, at the latter half of incubation, showing the adhesion of the diminished and inspissated part of the albumen to the area of the vitellicle, included by the *sinus terminalis*: the numerous wavy folds of the mucous layer of the vitellicle which converge to that part are also displayed.
3430. A portion of the mucous, vascular and serous layers of the vitellicle, showing the centre of convergence of the so-called 'vasa lutea,' which are the undulated vascular folds mentioned in the preceding description.
3431. A similar preparation.
3432. A section of the mucous, vascular and serous membrane of the vitellicle: a portion of the mucous layer clearly exhibits the true nature of the

wavy membranous folds by which the surface for the absorption of the yolk is increased: the vascular layer, from which the mucous layer is in part reflected, is bounded by the small 'vena' or 'sinus terminalis'; above this is extended the serous layer, which is continued into that which incloses the remnant of the albumen.

3433. The stomach and intestinal canal with the umbilicus and anus, and a portion of the vitellicle included within the abdomen of a young Gosling: the slender, short, and now ligamentous vitelline duct is shown; the urachus, or pedicle of the allantois, which passes from the anterior part of the rectum to the umbilicus, presents a nearly similar condition; the large proportional size of the 'bursa Fabricii' at the posterior part of the rectum deserves especial notice.
3434. The umbilicus of a young Gosling, with the vitellicle, which has been included within the abdomen, minutely injected: a portion of the small intestine with the ductus vitello-intestinalis is preserved, and a bristle is passed through the latter tube.
3435. A young Duck, towards the close of incubation, at the period when the yolk is about to be taken into the abdomen.
3436. The trunk of a young Duck at the conclusion of incubation, showing the umbilicus after the passage of the yolk into the abdomen.
3437. The stomach of a young Gosling towards the conclusion of incubation, laid open to show the coagulated nutrient material, which has been transmitted to it by the small intestine from the vitelline duct in process of digestion.
3438. The stomach and duodenum of a Gosling at the close of incubation, laid open to show the contained coagulum of nutrient matter.
3439. A Chicken, soon after exclusion from the egg, with the ventral parietes of the abdomen removed to show the remains of the vitellicle within that cavity adhering to the internal border of the umbilicus.
3440. A similar preparation, in which the short, plicated, umbilical pedicle of the included vitellicle and the form of the recently closed umbilicus are well displayed.



3441. A similar preparation, in which the included vitellicle is laid open and its contents removed to show the wavy, vascular and absorbent plicæ of its lining membrane.
3442. A portion of the ventral parietes of the abdomen, including the recently closed umbilicus of a Chick, a few days older than the preceding specimen: this shows the diminished vitellicle adhering to the inner surface of the umbilicus, and connected, by means of the ductus vitello-intestinalis, now reduced to a long and slender filament, to the small intestine, of which a loop is preserved.
3443. A Hen's egg towards the conclusion of incubation, from which a portion of the attenuated shell has been removed to show the change which takes place in the condition of the membrana putaminis during incubation; it now resembles a layer of thin parchment: a part of the membrana putaminis is removed to show the vascular layer of the allantois.
3444. A Hen's egg towards the close of incubation, from which both a portion of shell and of the membrana putaminis have been removed so as to exhibit the vascular allantois and the vesica aëris: the latter is increased in size; it is ruptured by the chick on the nineteenth day of incubation, when the lungs begin to perform their functions by means of the oxygenated gas which this vesicle contains.
3445. The contents of the egg of a Goose, when two-thirds of the period of incubation have been completed, showing the position of the embryo at that period: it is bent upon itself, and sunk into a deep cleft in the substance of the albumen: the vascular allantois has been injected; it is suspended by the umbilical vessels and by the duplicature of the serous or false amniotic membrane, which it carried before it during its rapid expansion and growth.
3446. The egg of a Goose at a similar period of incubation laid open and its contents removed, excepting the vascular layer of the allantois, which is applied to its inner surface; the vessels of this membrane are in many parts minutely injected; they are ramified, as in the persistent respiratory organs, so as to submit the blood of the chick in a state of ex-

tremely minute subdivision to the atmospheric air, which gains access to it through the pores of the shell and membrana putaminis.

3447. The young of a species of Penguin, or of one of the Brachipterous swimming birds, at the close of incubation, with part of the egg-coverings: the mode in which the young bird is disposed, so as to form an almost spherical ball, adapted to the shape of the cavity in which it was developed, is worthy of observation; the head is twisted obliquely to the right, and covered by the right wing and corresponding foot: a portion of one of the vessels of the allantois hangs from the nearly closed umbilicus: the anus, the short tail, and the orifices of the oil-gland above the tail may be seen: the body is covered with a short and fine dark-coloured down: the beak is armed with a horny knot placed above the end of the upper mandible.
3448. A series of preparations of the viscera of the embryo of the Fowl up to the time of the commencing development of the allantois, prepared principally to show the changes in the form and structure of the heart; this, in the upper specimen, appears as a simple muscular canal, bent upon itself from left to right, with the concavity looking upwards: in the next specimen there is a slight expansion at its commencement, indicating the situation of the auricle; in the third, a single enlargement at its termination forms the bulbus arteriosus; in the fourth, or lowest specimen, the intermediate or ventricular mass has acquired a disproportionate size, and is well distinguished from the other two parts.
3449. The heart of a Gosling near the close of incubation, showing the very deep 'fossa ovalis' in the right auricle, and the small foramen of communication between the two auricles; the ventricles are laid open, showing the integrity of their septum and their valves; a fine tendinous cord is here seen to be attached to the free margins of the large muscular valve of the right ventricle.
3450. The principal thoracic and abdominal viscera of a Gosling towards the close of incubation minutely injected: the elliptical form and valvular projection of the foramen ovale into the left auricle is beautifully shown in this specimen. The two arteriæ innominatæ are laid open, showing

the thickness of their coats; the stomach is cut away to expose the spleen; the trunks of the vitelline and allantoic veins are displayed, and a piece of black thread is tied round their corresponding arteries.

3451. The brain of a young Gosling at the close of incubation, showing the descent of the optic lobes from the upper to the lateral aspects of the brain, and their disproportionate magnitude as compared with the cerebral hemispheres at this period of life.
3452. A Partridge near the close of incubation, showing the well-developed beak and legs, and the plumage of down-tufts with which it is covered; all of which are provisions for enabling it to follow the parent bird and procure its own sustenance as soon as it has chipped the shell. The birds in which the chick acquires this advanced stage of development during incubation, and which include, with few exceptions, the Gallinaceous, Grallatorial, and Natatorial Orders, are termed 'Aves præcoces.'
3453. A young Passerine bird, after the completion of incubation, showing the helpless condition in which it, like the rest of the 'Aves altrices,' is hatched, viz. naked and blind, or with the eyelids closed; the remains of the vitellus may be discerned through the parietes of the recently completed abdomen; the quill-feathers are just beginning to protrude through the skin; there is no trace of the horny knob upon the beak, the exclusion of the chick and the breaking of the shell being chiefly the work of the parent.
3454. The young of the same species of bird at a more advanced period of growth, with the gubernacula of the principal clusters of feathers protruding through the skin: the fissure of the eyelids is here established.
3455. A young Cuckoo, with the development of the plumage much farther advanced than in the preceding specimens: the thin cuticle has been reflected from the protuberant abdomen.
3456. A series of six heads of young Goslings at different stages of growth, to show the progressive development of the eyelids and of the deciduous horny knob near the extremity of the upper mandible: the first tegumentary protective fold of the eyeball is that at the inner canthus of the eye, which afterwards forms the 'membrana nictitans'; then the inferior



eyelid is progressively extended over the eyeball from below upwards : the external nostril at first appears merely as a simple slit, but is afterwards provided with two prominent margins ; an analogous opercular tegumentary fold is developed to protect the originally simple external aperture of the meatus auditorius.

- 3457. The head of a young Gosling at the close of incubation, showing the condition of the eyelids, external nostrils, and the horny knob on the upper mandible, with which the shell is broken in the act of exclusion from the egg.
- 3458. A similar specimen injected, with the lower jaw removed, to show the posterior termination of the nostrils, which communicate with the mouth by a single elliptical aperture : behind this is a similar common termination of the Eustachian tubes or internal passages of the acoustic cavity.
- 3459. The head of a Chick at the close of incubation, showing the shell-breaking knob at the top of the upper mandible.
- 3460. A similar preparation.

## SERIES XV. In Mammals.

### *a.* In the Placental Sub-class.

- 3460 A. A section of a female Ornithorhynchus (*Ornithorhynchus paradoxus*, BLUM.), with the generative organs displayed *in situ* : the left uterus is impregnated ; it contains two ova : the ovisacs, or Graafian vesicles, from which they have escaped, project some way beyond the surface of the ovarium ; the stigma or place of exit is of a circular form, and is still open ; its margin is formed by the thickened and everted lining of the ovisac ; a bristle is inserted into the orifice of the posterior one. The ova are retained between folds of the thickened, soft, vascular and finely plicated lining membrane of the uterus, but they do not adhere to that membrane, nor is there any appearance of a preparation in the uterus for the establishment of a placental relation with the foetus. The chorion or external membrane of the ovum is thin, smooth, and semi-transparent ;

the vitelline mass is large in proportion to that of Mammalian ova generally, but small as compared with the vitellus of the fowl and other Oviparous Vertebrates: it has subsided to the lower part of the larger ovum, and can readily be distinguished from the clear and fluid albumen above it: the ovum presenting these appearances, and which seems to have been the first that reached the uterus, is of a spherical form, measuring three lines in diameter; the second ovum is of smaller dimensions, owing apparently to the smaller quantity of albuminous matter which it has imbibed.

Thus the change which the ovum has undergone in this segment of the efferent generative tube of the Ornithorhynchus, which is analogous to the calcifying segment of the same tube in the bird, is not an acquisition of a defensive covering in relation to external incubation, but an expansion of the chorion by imbibition of a sero-albuminous fluid: moreover, the quantity of vitellus—a part which is essentially a product of the ovarium, and not capable, as such, of increase in the uterus or other parts of the generative apparatus,—is inadequate to the exigencies of a warm-blooded embryo destined to be developed out of the body of the parent. The chalazæ, which are continued from the membrana vitelli into the albumen of the egg of the fowl, and which there constitute a mechanism subservient, if not essential, to the success of incubation, have been ascertained to be wanting in the ovum of the Ornithorhynchus: it is moreover highly improbable that the chorion of the ovum of the Ornithorhynchus should imbibe in the uterus so great a quantity of albumen as would compensate for the scantiness of the vitellus; and the albumen, which the ovum has here acquired, is deficient in the consistency which an ovum destined for external incubation requires: there is likewise no part of the efferent tube beyond the uterus that possesses a structure which can be conceived to be capable of forming a shell around an ovum, even if it should be enlarged by imbibition of the uterine secretion to such dimensions as the closed bony pelvis of the Ornithorhynchus would give passage to: it is to be inferred, therefore, that the Ornithorhynchus is developed *in utero*, but the conditions of the foetal membranes and the period of uterine gestation remain to be ascertained.

In this preparation it may be noticed that the right ovarium and uterus have taken on an increase of size in obedience to the sexual stimulus, though proportionally less than the impregnated parts on the opposite side; the urinary bladder is reflected downwards in front of the uterine tubes; the rectum is situated in their posterior interspace. A bristle is placed between the two hind legs, with its extremities inserted into the cutaneous cavities of the heel containing the rudiment of the perforated spur, which so conspicuously characterizes the same parts in the male; the external aperture of the cloaca may be seen below the line of the divided integument under the base of the tail.

*Prepared by Mr. Owen, from a specimen presented by George Bennett, Esq., F.L.S.*

3460 B. The ovaria, oviducts and uteri of a Kangaroo (*Macropus major*, SHAW).

This marsupial quadruped is uniparous. The left uterus has been impregnated; the vacated ovisac with its much-thickened membrane occupies the greater part of the small ovarium; the ragged orifice with its everted margins, from which the ovum has escaped, is still uncicatrized: bristles are inserted into the oviducts, and both uteri are laid open; the left one, which was impregnated, is much enlarged; the lining membrane is thrown into numerous minute irregular rugæ, and is separated from the muscular coat by an abundance of soft vascular cellular tissue.

*Presented by George Bennett, Esq., F.L.S.*

3460 c. The fœtus of the Kangaroo, with part of its membranes, removed from the preceding uterus; it is apparently between the fifteenth and twentieth day of uterine gestation; it measures an inch in length from the head to the extremity of the tail; the mouth is widely open; the tongue large and protruded; the nostrils are small round apertures; the eyeball not yet defended by the palpebral folds; the meatus auditorius externus is not provided with an auricle; the fore-extremities are the largest and strongest; they are each terminated by five well-marked digits; those of the hind legs are not yet developed: the cervical fold of the mucous layer or the branchial fissure is still unenclosed by the integument: the thorax is laid open to expose the heart; the lungs were found to be pre-



cociously developed; the abdomen has been laid open, and the intestinal canal with the loop of small intestine to which the vitellicle or umbilical sac is attached, is seen extending into the umbilical cord; part of the liver has been dissected away to show the course of the vitelline vein beneath that gland to join the abdominal cava; this course of the vein, with the ascertained origin of the corresponding artery from the mesenteric branch of the aorta, and, finally, the place of attachment of the pedicle of the very large and vascular sac into which the umbilicus of the foetus expands, determines its nature as the homologue of the vitellicle of the embryo of the fowl, and of the so-called 'vesicula umbilicalis' of the human and mammiferous embryo. The foetus is immediately and pretty closely invested by an amniotic sac, reflected around it from the end of the short umbilical cord. The embryo, with the amnios and umbilical sac, is included in a thin unvascular chorion, which adheres at one part to the vitellicle; the digital divisions of the hind legs are not yet formed.

*Prepared by Mr. Owen, from a specimen presented by  
George Bennett, Esq., F.L.S.*

3460 D. The female generative organs of the same species of Kangaroo, killed towards the close of uterine gestation, with the left impregnated uterus laid open, showing a portion of the thin unvascular chorion which enclosed the embryo and its appended sacs.

*Prepared by Mr. Owen, from a specimen presented by Dr. Sweatman.*

3460 E. The foetus and its appended sacs, removed from the chorion and impregnated uterus of the preceding specimen: it has nearly reached the close of uterine gestation, which has been ascertained not to extend beyond thirty-nine days: development of the embryo has proportionally advanced; the mouth and tongue present a size and form adapted to grasp the parent's nipple; the well-formed nostrils are prepared for external respiration; the fore-legs are strongly developed, and the small prehensile claws are perfected at the extremity of the digits so as to be ready to grasp the nipple: the rudiments of the toes on the hind-feet are developed, with indications of their characteristic proportions and conditions, as, e. g. the inclusion of the two inner toes in the same cutaneous sheath, and the large size of the adjoining toe. The amnios is

reflected from the embryo upon the umbilical cord and sac; a small allantois is now developed, and its continuation from the urachus is shown; it is, however, in no way destined to aid in the development of the placenta, but is apparently limited to its minor function as a receptacle of the renal excretion of the embryo; the abdomen is laid open, showing the liver *in situ*, the right Wolffian body, and the intestinal canal; the number of convolutions of this tube is increased; its relations to the duct and vessels of the vitellicle are shown.

*Prepared by Mr. Owen.*

- 3460 F. A portion of the inspissated secretion, from one of the lateral vaginal tubes of a Kangaroo. *Presented by Sir Everard Home, Bart.*
3461. The young or mammary foetus of a Kangaroo, removed from the nipple and pouch of the mother within three weeks after birth. The foetus is perfectly naked, with the traces of the closed eyes and ears scarcely perceptible; the nostrils are widely open; and the mouth presents the form of a small, round, terminal aperture. The entire length of the foetus does not exceed one inch and a half; and, at this period, the fore legs exceed the hind legs in length, agreeably to the usual laws of mammiferous development.
3462. A pregnant Water-rat (*Arvicola amphibia*, Cuv.), with the ventral parietes of the abdomen removed and the uterine tubes exposed, through the thin parietes of which the included foetuses may be discerned; their development is nearly complete.
3463. A portion of the uterus, with two foetuses, of a Water-rat; one of these is inclosed in the chorion, and is attached to the uterus by means of a small circular placenta; this body is convex towards the uterus, and presents a flat surface to the chorion, which is attached to the centre of the disk; the chorion has been removed from the other foetus, showing the short and straight umbilical cord which contains the ducts and vessels of the vitellicle and allantois.
3464. A foetus of the same species, with its placenta, a portion of its membranes, and of the uterus to which the placenta is attached.
3465. A foetus and its membranes of a Water-rat: the chorion is laid open to

show the vitellicle, which is nearly co-extensive with it, and consequently of large size; the allantois is comparatively small, but is subservient to the development of the placenta; the vessels of the vitellicle, although uninjected, may be discerned with the aid of a pocket-lens.

3466. The trunk of a Rat (*Mus decumanus*, LINN.), with the ventral parietes and most of the viscera of the abdomen removed, to show the female organs at an early stage of impregnation; each of the embryos is contained in a special dilatation, appended to the side of the uterine tube: the ovaria, like those of the *Ornithorhynchus*, exhibit a racemose or grape-like form.
3467. A portion of the impregnated uterus of a Rat; one of the dilated parts, containing the embryo with its membranes, is left entire; these have been removed from a separate dilatation to show the cotyloid form of the maternal placenta, which is adapted to a small convex lobe, or button-shaped process on the middle of the uterine surface of the foetal placenta: the folds or processes of the lining membrane of the uterus, which converge to be attached to the maternal portion of the placenta, are here shown; the third uterine dilatation is laid open, and the foetus, with its membranes and placenta, are suspended from the maternal placenta, elucidating the office of the processes of the lining membrane of the uterus, above described as supporters of the embryo and conductors of the vessels of the maternal placenta. Fine elongated villi are developed from the external surface of the chorion, near the circumference of the placenta.
3468. A foetus of a Rat, with its appended membranes and part of the chorion; the placenta is small, subcompressed and circular; the small convex lobe which projects from the centre of its uterine surface is here distinctly shown.
3469. A Mouse (*Mus Musculus*, LINN.), with the abdomen laid open, to show the impregnated uteri near the conclusion of gestation.
- 3469 A. A Mouse injected, with the abdominal and thoracic cavities laid open, and the impregnated uteri near the close of gestation reflected downwards; each horn of the uterus contains four foetuses; one of the foetigerous



dilatations is laid open, the chorion removed, and the embryo suspended from the placenta by its short umbilical cord.

*Prepared by Mr. S. Stutchbury, A.L.S.*

3470. The urogenital canal, vagina and uterus of a Squirrel (*Sciurus vulgaris*, LINN.): two of the fœtiferous dilatations are laid open; in one the chorion is left entire, and the filamentary villous processes from that part of its outer surface, which is to form the seat of placental attachment, are beautifully shown: in the other dilatation the chorion and amnios are laid open so as to expose the embryo; this is about eight lines in length; the digits are not yet developed on the rudimental extremities; the umbilical cord is very short and wide, and contains a loop of the intestine.
3471. The vaginal extremities of the two uteri of a Rabbit (*Lepus Cuniculus*, LINN.), minutely injected, in one of which is an embryo far advanced in development; a portion of the delicate transparent chorion, corresponding to the head of the embryo, has been removed; the tail is directed towards the os tinæ; the longitudinal muscular fibres of the uterus are beautifully displayed in this preparation; the fine transparent folds of the vascular lining membrane are shown in a portion of the opposite uterus; the delicate reticular structure of this membrane may be observed with the aid of a pocket-lens.
3472. The ovarium, oviduct, and contiguous portion of one of the uteri, with a fœtus and its membranes near the close of uterine gestation, of a Rabbit: the vessels of both the uterus and embryo have been injected; the chorion and amnios are laid open and reflected from the embryo, which is suspended by the short umbilical cord; the hypogastric or allantoic, and the omphalo-mesenteric or vitelline arteries, are both filled with red injection thrown into them by the aorta; the umbilical or allantoic vein, uninjected and of small size, may be seen passing upwards to the liver; the vitelline vein accompanies its artery beneath the liver: the placenta presents a subcompressed oblong shape, and is lobulated.
- 3472 A. Two fœtal Hares (*Lepus timidus*, LINN.), the lower one is inclosed in its amniotic bag.

*Presented by Sir William Blizard, F.R.S.*

3473. A young Guinea-pig (*Cavia porcellus*, LINN.), soon after birth ; the permanent incisors have cut through both upper and lower jaws ; the deciduous ones are shed in utero.
3474. A foetal Agouti (*Dasyprocta Agouti*, ILLIG.), near the close of uterine gestation ; the fissure of the eyelids is closed at this period, as in most other Rodentia, which, like the Carnivora, are born blind.
3475. The foetus of some large Rodent quadruped ; a process resembling a rudimentary nipple may be observed on the inner side of each thigh, near the knee-joint.
3476. The foetus of a Porcupine (*Hystrix cristata*, LINN.). The situations where the principal quills are to be developed are indicated by modifications of the external surface of the skin, but as yet the foetus has only a scanty covering of long and soft hairs.
3477. A foetus of the Cape Ant-eater (*Orycteropus capensis*, CUV.); it is about four inches in length ; the tail is strong, but proportionally short as compared with the adult.
3478. A foetal Pangolin (*Manis brachyura*, TEMM.), about six inches in length ; the lozenge-shaped tegumentary scutæ are marked out, but their margins, which are still soft, are not so produced as to overlap each other ; the strong claws are developed on the toes ; the margins of the eyelids are coherent ; the umbilical cord is short, and gradually expands as it recedes from the foetus. A part of the amnios is shown at its point of reflection from the allantois ; only small and lacerated portions of the other membranes are preserved.
3479. A foetal Armadillo, with its umbilical cord, at near the close of uterine gestation ; the characteristic divisions of the tegumentary armour are all clearly displayed.
3480. A foetal Sloth (*Bradypus tridactylus*, LINN.), at the latter period of uterine gestation ; the pectoral situation of the mammæ, and the rudiment of a thumb, deserve notice in this preparation.

[The following eighteen preparations are illustrative of the development of the foetus of the Sheep, and some of them are described by

Hunter in the subjoined Note\*, of which a copy was made from the original Manuscript by Mr. Clift.]

3481. The female organs of an Ewe (*Ovis Aries*, LINN.); each ovarium is bisected, and an old corpus luteum, in progress of absorption, is present in both; a bristle is inserted into the abdominal aperture of each Fallopian tube; the right horn of the uterus is laid open to show the longitudinal series of cotyledonal processes; the cervix uteri and beginning of the vagina are also laid open to show the series of valvular processes, directed towards the vagina, and progressively increasing in size as they approach that canal.
3482. The uterus of an Ewe, at the period of sexual excitement; the left ovary is bisected, and a large ovisac is divided, which has contained an ovum ripe for impregnation; the inner surface of this ovisac, against which a bristle is placed, is irregularly plicated; the stroma of the ovary presents a laminated texture, and the layers surround the ovisac concentrically: at the base of the ovary is a plexus of vessels, which are injected; a small

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\* "*Experiments on the Impregnation of Ewes.*

"1st EWE.—A young Ewe was allowed to go with a Ram that could not copulate till she was in heat, and allowed to go with him for twenty-four hours after, so as to be perfectly in order for copulation. She was killed, and on examining the fimbria *in situ* they did not inclose the ovaria, nor were they very long. The parts were taken out and examined. As this breed has seldom more lambs than one, I examined carefully for the ovarium that was preparing for impregnation, and saw suspicious parts on both. One, which I conceived to be most so, having a point upon it, I slit down through this point, and could plainly see a substance more solid than the surrounding parts, of a light yellow, with a cavity in form of a slit, or small groove, which was now divided by the incision, one end of which was towards the external surface or point.

"On observing the other ovarium, I also saw two suspicious points; and when I cut into them in the same way, I found them belonging to one body, in which I could observe the same appearance, excepting the cavity. How far this was also becoming preparatory to generation, and would have gone back, even although the Ram had served her (for I cannot suppose she would have had two lambs), I do not know. On slitting up the vagina, the two horns, and also the Fallopian tubes, I could not observe that they contained anything but a slight lining of a slimy mucus.

"2nd EWE.—The second Ewe had taken the Ram twenty-four hours before she was killed, and immediately opened upon dying. I observed the fimbria lying spread on each ovarium. They were long and broad, and slimy or gelatinous; for when I pulled them off they dragged, and as it were stuck to the ovarium.

"The vagina was large and soft in its texture. The parts were taken out largely, put into water,



section has been removed from the opposite ovarium, and the Fallopian tube and uterine horn of the same side have been slit open; a part of the cavity of the opposite uterine horn is exposed; the summits of the cotyledonal elevations are slightly depressed, as if preparatory for the reception of the capillaries of the foetal cotyledons.

3483. The uterus of an Ewe, a short time after impregnation: each ovarium presents an orifice supported upon a nipple-like prominence, from which the impregnated ovum has escaped: a section of the left ovarium has been made by the side of this perforated prominence, and the cavity of the vacated ovisac is exposed; this is encroached upon by the irregular folds or processes of the vascular and thickened parietes of the ovisac, by the mutual cohesion of which its cavity is destined ultimately to be obliterated: the Fallopian tube and uterine horn of that side have been laid open through their whole extent; the cavity of the valvular cervix uteri, and that of the beginning of the vagina, are likewise exposed: a bristle is inserted into the abdominal aperture of the right oviduct.

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and injected. Next morning I was astonished to find the vagina so much contracted, and (the fimbria) instead of being gelatinous they were pretty flexible membranes.

"Each ovarium had a pouting nipple upon it, one of which seemed to have burst and thrown out a little mucus. On dividing one longitudinally nearly in the centre, I found a distinct cavity filled with a mucus, not slime.

"3rd EWE.—This Ewe had taken the Ram forty-eight hours before death. She was killed. I could not observe that the fimbria were connected with them (the ovaria?). The parts were taken out and injected, and were more easily injected than the former. There were two nipples, one on each ovarium; they were more pointing than the former and of a red colour, and had an orifice in the middle. On slitting up the uterus I found a curdy mucus in the valvular part, but I could not observe any in the horns of the uterus, which I slit up, nor any appearance of impregnation. I slit up the Fallopian tube its whole length and found mucus in it, more especially near its larger opening, but could find nothing like an ovum. I next split down the ovarium by the side of the nipple, and cut off a small section from the cup or calyx, and found it larger than (in) the second; irregular on its inner surface, filled with a mucus similar to that in the Fallopian tube, but contained nothing like a regular body or ovum. The cavity on the inside was rough, and the little pointing nipple on the surface led into it. I took a section off the top of the other ovarium, and found the same kind of cavity, with the same kind of mucus. The uterus had a considerable deal of mucus in it, as also the Fallopian tubes, which appeared at their mouths, and indeed some of it was loose in the hollow formed by the fimbria. Whether this was semen or not, I could not say; but when put into spirit it coagulated.

"4th EWE.—She had taken the Ram three days, or seventy-two hours. I could not observe that

The appearances in this preparation correspond with those described by Hunter, in the Ewe which he killed and examined twenty-four hours after she had taken the Ram.

3484. A similar preparation : the corpus luteum or vacated ovisac in progress of obliteration, which is exposed by the section of the left ovarium, is dissected so as to exhibit what appears to be a distinct lining membrane ; a bristle is passed through the aperture by which the ovum has escaped. The appearances in this preparation correspond with those described by Hunter in the 4th Ewe, which he killed and examined on the third day after she had taken the Ram.
3485. The uterus of an Ewe, killed four days or ninety-six hours after having taken the Ram : the appearances presented in this preparation are described by Hunter in the subjoined "Experiments," under the head of the "5th Ewe."
3486. A similar preparation from an Ewe : the appearances represented by this preparation are described by Hunter under the head of the "6th Ewe :"

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the fimbria were at all attached to the ovaria. She had but one nipple (on the ovarium), which was large and pointing, as if a continuation of the corpus luteum, pushing through with a large dent or cup on the top, leading into the cavity. The whole corpus luteum and nipple was red with vessels.

"I slit up the vagina, and found a curdy soft mucus in that part where there is a series of mouths. I then slit up the horn belonging to the corpus luteum, but found only mucus there ; then the Fallopian tube its whole length, and found the same kind of mucus in it ; as also the same kind in the other tube, whose ovarium was not impregnated. I then removed a portion of the bulging side of the ovarium, and found it granulated or conglomerated like a pancreas, and came to a lining or bag exactly similar to one of the animal hydatids. I separated that portion of the granulated structure from it, which I had cut into, leaving a large opening which exposed this bag : I then made an opening into it, and found a fluid with some mucus.

"5th EWE.—This Ewe had taken the Ram four days, or ninety-six hours. On opening her I found the fimbria, as it were, inclosing the ovaria, and required to be dragged off like wet linen.

"Both ovaria had nearly the same projecting nipples, and nearly in the same parts of the ovaria ; the left was rather the largest, and extremely red in its projecting part, with also a red base ; but the right was white, or of the common colour of the ovarium. In the centre of each of these nipples appeared an opening, the lips of which appeared to be the inside of the projection turned a little out ; both sides were injected, which showed that the redness of the left mamma was owing to its vascularity. The right was not nearly so red.

"On slitting up the uterus I found more mucus in it than common, and more of the slimy kind. On

he has inserted a bristle into the cavity of the ovisac, from which the impregnated ovum has escaped; the depressed or flat surface of the summit of the uterine cotyledons exhibits a richly vascular and fine villosity; the villi being short, and resembling minute specks of injected matter projecting from the orifices of correspondingly minute canals.

3487. A portion of the coloured or injected substance, removed from the preceding uterus.
3488. The ovarium and oviduct of a Sheep, killed six days after having taken the Ram: the ovarium is bisected, showing the cavity of the ovisac from which the impregnated ovum has escaped, obliterated by the thickened and vascular tunic; the loose cellular tissue connecting this substance with the proper stroma of the ovarium is highly vascular.
3489. A similar preparation, presenting the appearances described by Hunter under the head of "Experiment 7th, repeated."
3490. A similar preparation from an Ewe, killed eight days after having taken the Ram: the appearances in this preparation correspond with those de-

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slitting up both the horns, I could hardly observe anything in them, excepting near the Fallopian tube there was a little mucus. After it had been in spirit, so as to harden the parts, I could pull off from the concave side of the left fimbria a thin coat of mucus, which, I suppose, had been a thin coat of slime, but now coagulated by the spirit.

"I now slit up the whole of the Fallopian tube, but found nothing but mucus, now coagulated so as to break to pieces like flakes. On taking off a section from the side of the ovarium, from the neck of the nipple along the base as deep as the cavity, as also a section of the cavity (along) with it, leaving the orifice in the nipple entire, I observed the following appearances: the surface of the cavity now exposed was very large, yet its sides were almost in contact; it was not a flat even surface, but composed of protuberances close upon each other, so as to form narrow chinks between each: about half a dozen might occupy the whole surface of the cavity. On the inside of this, or in the cavity itself, was a pretty firm substance like mucus, which, when taken out, was of the shape of the cavity, as if a cast. As these parts had been injected, the parts composing the cavity were extremely vascular, especially on the surface. There was a speck of injection on the above-mentioned cast (contained in the cavity). The ovarium on the right side had no cavity; only the projecting nipple.

"6th EWE.—This Ewe had taken the Ram five days, that is, 120 hours. There was only one ovarium preparing for impregnation: it did not appear quite so vascular as the fifth or last. I first removed the outer covering of the corpus luteum, and found that this body on its external surface, all round, was distinct from the covering or common substance of the ovarium, only attached by common cellular membrane, and I could have turned it out as a distinct body, having a conglomerated surface, like a conglomerated gland. On removing a section of this, so as to expose its cavity, I



scribed by Hunter under the head of the "8th Ewe." After the bisection of the ovarium, containing the two corpora lutea or obliterated ovisacs, a section has been made of the cut surface of one of these, in which the remnant of the ovarian cavity, in the form of a linear trace, leading from the centre to the circumference of the corpus luteum, may be observed.

3491. Two of the uterine cotyledons of an Ewe, killed five days after having taken the Ram; they are minutely injected: the very vascular spot on the summit of the cotyledon consists of a group of close-set, very short, obtuse papillæ, resembling specks of red injection; this group is surrounded by a non-vascular border, exterior to which the surface of the cotyledon presents a number of minute vascular points.
3492. A vertical section of the uterine cotyledon of an Ewe, at the same period of gestation, with the vessels minutely injected, dried and preserved in oil of turpentine.
3493. Two embryos with their membranes, of a Sheep: the embryos are each

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found it rather less than the former, and made up of risings of the sides. I found no mucus or anything in it; so that it gave me the idea, at the time, of having finished its business, and was on the decline.

"I next slit up the vagina and common uterus to the going off of the two horns. I found some mucus in them. I then slit up the horn of the impregnated side, and about an inch from its beginning I observed the end of a seemingly unattached body leading further into the horn; and on slitting it up its whole length, this substance was found everywhere in the centre. I observed, as I went along, that it was attached to each knob or cotyledon, and by vessels: it would seem not to be perfectly continued, but interrupted in one or two places. Although nothing had gone on in the other ovarium, yet I wanted to see if any preparation was going on in the other horn; and on slitting it up in part, I saw the same substance in it, but not quite so thick. This substance was, in a slight degree, modelled to the cavity of the horn, but not so distinct, or even [so large as] to increase its cavity. It was extremely red, as if extremely vascular, which at first made me suspect it was extravasation of the injection, which was glue loaded with colour; but by putting some of it into boiling water, it rather became more solid than melting as glue would have done.

"I slit up the Fallopian tube its whole length, in which I found a good deal of mucus, but did not find anything like a body or substance different from the mucus.

"7th Ewe.—She had taken the Ram six days, or 144 hours. On examining the parts in their situation, I observed that the fimbria of the impregnated side inclosed the whole ovarium, and it clung close to it (on) pulling it off. One of the ovaria had the corpus luteum projecting pretty considerably, but there was no opening or cup formed by a protrusion, or what seemed a prolapsus of the passage

about eight lines in length, and the extremities are just beginning to be developed; the chorion and amnios are laid open so as to expose one of these embryos, in which the extremity of the vitellicle is exhibited; the allantois has carried the hypogastric vessels to the chorion, but the foetal cotyledons have not yet begun to be formed.

3494. A portion of one of the horns of the pregnant uterus of an Ewe, from which the foetus and its membranes and cotyledons have been removed, and several uterine cotyledons of different sizes displayed: the parts have been injected.
3495. The extremity of the horn of a uterus of an Ewe, with a portion of the chorion and allantois of the embryo which has been removed; it shows the great enlargement of the uterine cotyledons, which present the form of a bee-hive, the apex being excavated to receive the vascular villi of the foetal cotyledons.
3496. A portion of the uterus, with one of the uterine cotyledons and the corresponding foetal membranes, of a pregnant Ewe; the combined foetal

leading into the cavity; nor was there a cavity within the body: the whole a solid vascular substance, distinct as usual from the outer parts of the ovarium. There was no operation going on in the uterus. The same kind of mucus in the Fallopian tube that I found in the former. [This, as it explains nothing, is to be considered as nothing.—J. H.]

*“A continuation of the Experiments on Ewes.”*

“Experiment 7th was repeated in October, 1792. The corpus luteum was very large and projecting, appearing, after being injected, as if the whole was likely to burst out of the ovarium. The top was flattish, with a hollowish line running across it, with a small opening at each end of this line. It had exactly the appearance as though it had been a round opening on the top of the projection, and now the two sides of it had been pressed together, making a long opening, and which had united in the middle, but not quite at the two ends. On slitting this body down near this line of union, I found it, as it were, composed of parts very like a conglomerated gland, with a cavity some way under the projecting surface; and by endeavouring to introduce a bristle from the two lateral openings down into it, they seemed to pass so easily everywhere, that I was not certain whether they went through the substance itself, or into natural passages. There was, at what appeared to be the bottom of the two openings, somewhat nearer the opening than the cavity above-mentioned, a dark spot, but which was a loose body, for it was easily tilted out, and appeared to be a remains of coagulated blood. I could not find anything in the tubes, nor anything going on in that horn of the uterus.

“8th EWE.—Not having found much satisfactory progress in the two last (experiments), I allowed this Ewe to live 192 hours, or eight complete days, after having taken the Ram. Before injec-

and maternal cotyledon has been bisected, which shows the form and size of the cup-shaped cavity at the apex of the maternal cotyledon, and the thickness of the vascular tissue, which is composed of the interblended villi of the two parts.

3497. A section of the uterus of a pregnant Ewe, including four cotyledons with a corresponding part of the foetal membranes; the mucous or lining membrane of the uterus is reflected from the side of the cotyledon; the fibrous tunic surrounds the whole of its base; the thickness of this investment of the foetal cotyledon, and its extent, are well displayed in this preparation.
3498. A conjoined foetal and maternal cotyledon of a Sheep, bisected.
- 3498 A. A foetal Sheep, between two and three inches in length, inclosed within the amniotic bag. *Presented by William Lawrence, Esq., F.R.S.*
3499. A small section of the chorion and allantois injected of an embryo Ox (*Bos Taurus*, LINN.), stated to have been about four inches long; the section has been removed from near the blind extremity of the chorionic sac, and shows the small size and rudimental condition of the cotyledons of that part.
3500. The caecal extremity of the chorion of the same embryo, showing the commencement of the formation of the foetal cotyledons, by the development of groups of minute branched villi in particular places; part of

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tion, I found the corpus luteum not so projecting as the former. A hollow in the middle of the projecting part, which had the appearance of a former opening, now closed. When injected, the whole became more full and turgid, and this opening, although now closed, yet became more evident. On slitting this down into two halves, I found two corpora lutea in the same ovary, and they both appeared the same through their whole substance. Conceiving (that) I should now see something, either in the Fallopian tubes or the uterus, I opened the tube its whole length, but found nothing but some cream-like mucus. In that horn of the uterus I found nothing but mucus, like thin dusky cream, with some white (substance) almost like curd in some of the interstices of the cotyledons."

"*Loose note.*—In a sheep, while the foetus is forming in the uterus, the Fallopian tubes become straight, small, and the canal also extremely small. Before any show in the uterus, they are rather larger than natural, convoluted, and containing mucus."—*Hunterian Manuscript.*

[The ovum of the Sheep being pellucid, colourless, and much more minute than Hunter had evidently anticipated, escaped his observation.]



the chorion is dissected from one side to show the vascular layer of the allantois in contact with it, which is called the endochorion : it is smooth, thin and transparent.

3501. A section of the same chorion and allantois removed from near the place of attachment of the embryo ; it exhibits the form and condition of two of the cotyledons at this period : they consist each of a subcircular group of branched, villous, vascular processes, which are highly vascular and have been minutely injected.
3502. A section of the uterus of a pregnant Cow, at a more advanced period of gestation, including one of the maternal or uterine cotyledons, which shows its reniform figure, its pedunculate mode of attachment, and its alveolar or honeycomb surface, produced by the orifices of the deep follicles which receive the branched and villous vascular processes of the foetal cotyledon.
3503. An uterine cotyledon of a Cow, detached from the uterus, with the corresponding foetal cotyledon, the branched and villous processes of which have been withdrawn from the alveoli at the base of the uterine cotyledon. On the opposite side of the preparation may be observed the smooth and comparatively unvascular allantois which is co-extended with the chorion.
3504. A section of an uterine cotyledon of a Cow, with part of the villi of the foetal cotyledon attached, and both minutely injected.
3505. A section of the chorion and allantois of the Cow, including four of the foetal cotyledons, minutely injected ; their structure, as composed of groups of elegant, elongated, conical, vascular, villous processes, is beautifully displayed in this preparation.
3506. A similar preparation.
3507. A section of the chorion and allantois, with a single foetal cotyledon injected.
3508. A large foetal cotyledon, the vessels of which have been injected with lake or carmine.
3509. A section of a foetal cotyledon.

3510. A section of the fœtal and uterine cotyledon, with the corresponding portions of the chorion, amnion and uterus of a Cow; the uterine vessels have been filled with white injection, the fœtal ones with red: some of the villous processes of the fœtal cotyledon have been withdrawn from the maternal alveoli; where they remain in their natural state of co-adaptation, the distinction of the fœtal and maternal portions of this simple form of placenta is beautifully indicated by the difference in the colour of their respective injections.
3511. A similar preparation, but the colour of the red injection of the fœtal cotyledon is much deteriorated.
3512. A similar preparation, in which a section of the conjoined maternal and fœtal cotyledons has been made vertically to their plane, from the inner side of the chorion, and carried into the cellular base of the maternal cotyledon.
3513. A horizontal section of the conjoined fœtal and maternal cotyledons of a Cow, carried through the base of the maternal cotyledon, and parallel with its plane.
3514. A horizontal slice of the conjoined fœtal and maternal cotyledons of a Cow; the area of the principal vessels of the fœtal vascular processes are distinctly shown on one side of this preparation.
3515. A fœtal Calf, three inches and a half in length, inclosed in its amnios, to which a portion of the allantois is attached; the vessels of the amnios, and the minute, opaque, amniotic glands scattered over its inner surface, may be noticed in this preparation.
- 3515 A. The ovaria, oviducts and impregnated uterus of a Fallow-deer (*Cervus Dama*, LINN.), minutely injected, exhibiting the fœtal fawn in its membranes, which are uninjected: portions of the fœtal cotyledons are detached from the circumference of some of the maternal cotyledons, which have been most successfully injected; the form of the elegant branched filamentary processes which compose the fœtal cotyledon is thus beautifully displayed; being blanched by maceration, their white colour well contrasts with that of the injected maternal cotyledons from which they have

been displaced : in a few places, where the injection has become extravasated, the foetal cotyledonal filaments have received a red stain, but the general result of this successful injection of one of the constituents of the combined uterine and foetal cotyledons demonstrates the absence of any direct continuity between the capillaries of the mother and foetus. The surface of the uterus, which is not developed into cotyledons, is smooth and comparatively little vascular.

*Prepared by William Clift, Esq., F.R.S.*

- 3516. A section of the chorion and allantois corresponding to one of the horns of the uterus of a Deer ; it is minutely injected by the hypogastric arteries, and shows the vascularity of the oblong cotyledons.
- 3517. A portion of the chorion of apparently the same species of Deer, showing a cotyledon of the oblong form and ordinary size ; and a second, of a subcircular form and of much smaller dimensions.
- 3518. A section of the chorion and allantois of a Ruminant, exhibiting two foetal cotyledons minutely injected ; they are of a circular form, and are composed of very delicate elongated filamentary processes, less branched and subdivided than those of the cow or deer.
- 3519. A section of the chorion of the same Ruminant, exhibiting a single foetal cotyledon, of which the arteries have been partially filled with red injection, and the veins with injection of a blue colour.
- 3520. A portion of the foetal cotyledon of a large Ruminant, minutely injected, with the filamentary branched processes partially unravelled.
- 3521. A foetal cotyledon of a Ruminant, injected, with part of the chorion and allantois, which membranes are separated from each other, and reflected from the base of the cotyledon.
- 3522. A section of the pregnant uterus of a Ruminant, including one cotyledon, to which the corresponding foetal cotyledon, with a portion of the chorion and allantois, is attached. The uterine cotyledon is minutely injected : the allantois or endochorion is reflected from that part of the true or 'exochorion', from which the foetal cotyledon is developed.

The name of the species from which this preparation has been taken



is not given in the Manuscript Catalogue; but the parts correspond in form and structure with those of the Cow.

3523. A section of one of the uterine cotyledons, minutely injected, of the same Ruminant: it shows the pedunculate mode of attachment, and the alveolar structure of the part; the alveoli are deep and narrow, with their parietes continued into each other so as to give a reticulate character to the surface of the cotyledon. The alveoli radiate in all directions from the centre or base to which the peduncle of the cotyledon is attached.
3524. A section of an uterine cotyledon of the same Ruminant, with the corresponding part of the foetal cotyledon attached: here the foetal portion is minutely injected, and the vascular branched villi are strongly contrasted against the blanched uninjected alveoli of the uterine portion. The allantois has been removed from the portion of chorion and cotyledon here preserved.
3525. A section of the uterus and of an uterine cotyledon, with the corresponding portion of the foetal cotyledon, chorion and allantois of a Ruminant: only the uterine cotyledon is here injected.
3526. A similar preparation.
3527. A section of the uterus, with an uterine cotyledon, and the corresponding foetal cotyledon with part of the chorion and allantois attached.
- The uterine cotyledon resembles in its form, and in the mode of its attachment, that of the Ewe, but is somewhat larger: it is injected; and some of the uninjected villi of the foetal cotyledon have been withdrawn from the maternal alveoli.
3528. A section of the chorion and allantois of a Ruminant, with two cotyledons: these are developed from pouch-shaped depressions of the chorion, one of which is everted, and the delicately-branched and villous processes of the foetal cotyledon are displayed.
- 3528 A. A portion of the chorion, allantois, and several of the foetal cotyledons of a Giraffe (*Camelopardalis Giraffa*, LINN.). The larger and normal cotyledons are of an oblong form, between two and three inches in diameter, arranged in longitudinal series, and attached by a contracted base

to the chorion; they are composed of elongated and extremely delicate branched villi, most resembling those of the deer. In the interspaces of the larger cotyledons there are numerous others of much smaller size: the chorion is very vascular: both the arteries and veins have been injected.

*Prepared by Mr. Owen from the membranes of the young Giraffe, born at the Zoological Gardens, July 1839, and presented by the Zoological Society.*

[The following seventeen preparations illustrate the embryology of the Sow; some of them may have been the subjects described in the subjoined Note, copied by Mr. Clift from the original Hunterian Manuscript\*.]

3529. The ovarium and oviduct injected of a Sow (*Sus domesticus*, LINN.); the large size and lobulated form of the ovary of this fertile quadruped

\* "Dec. 24th, 1781.—In a Sow, which took the Boar on Tuesday, and was killed the Thursday se'nnight following, in the morning, which was about ten days after, the glands of the ovarium ['ovisacs or Graafian vesicles'] were swelled a little, and when cut into were found to contain coagulated blood. Some of them contained pieces bigger than a cherry-stone; others were less. The horns of the uterus seemed preparing for the ova, being divided into compartments by a tightness or stricture, but of unequal lengths, some being as long again as others; and those divisions corresponded in one side with the number of glands in the ovarium of that side, being eleven in number: the compartments of the other side could not be counted, owing to its being longer in being opened, by which means the parts were not so distinct."

"A Sow, that had taken the Boar April the —, was killed April the —; viz. — days after. The following appearances were observed: [The dates are lost; however, it is not material; it shows the progress and difference in the same animal, some being further advanced than others.—J. H.]

"The ovarium of the right side was larger than that of the left. There appeared several ova ['ovisacs'] that were more vascular and larger than the others. There were eleven in number, each of which had a part projecting like a nipple, which was more evident in some than in others. The remaining number had this appearance beginning to take place; the other ova ['ovisacs'] were smaller, of a yellowish white, harder and firmer in consistence. When cut into, they appeared of the same colour (throughout) their whole substance.

"In one of the eleven there was an appearance as if it had burst. When cut into, it had an irregular appearance of a cavity in which there was extravasated coagulated blood. On cutting into the other ova ['ovisacs'], which seemed impregnated, (viz. those which had the projecting appearance,) they seemed to be taking on more the appearance of a cavity, which in some of them contained a yellowish serum; in others coagulated blood, but irregular in form, appearing like extravasation into the substance. This was much more (evident) in some than in others.

"In others, that had not the above projection, their cavities appeared more circumscribed and perfect; their inner surfaces were very vascular, with partial exudations of coagulated blood, and con-

deserves notice in this preparation, as also the complicated structure of the large pavilion or 'morsus diaboli', from which a bristle is passed into the oviduct or Fallopian tube.

3530. A section of one of the horns of the uterus of a Sow, minutely injected, showing the vascularity of the lining membrane about ten days after impregnation.
3531. A similar preparation.
3532. The ovaria, oviducts, and commencement of the uterine horns of a Sow : the large and lobulated ovarium is attached by a small part of its circumference near the mouth of the purse-like duplicature of the peritoneum (described in Nos. 2779 to 2782) ; the ovarium has been cut away from the opposite side, and a bristle inserted into the fimbriated portion of the oviduct or Fallopian tube : morbid hydatid cysts are developed in some parts of the mesometry.
3533. The ovarium, oviduct, and adjoining portion of the uterine horn of a Sow, sixteen days after the coitus : the orifice in the ovisac, or 'corpus luteum,' from which the ovum has escaped, is cicatrized : a section has been removed from the ovarium. A portion of the uterine horn is laid open, showing the vascularity of the transversely plicated lining membrane, and an ovum, in the form of an irregular string of albumino-fibrinous matter adherent thereto. The original bright colour of the injection has been changed by the chemical reaction of the menstruum to a dull leaden tint.

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tained a serum. The left ovarium had seven of the ova ['ovisacs'] of a red colour, four of which had a projection. One of them seemed ready to burst ; and, in cutting into its substance, one cavity, whose surface was vascular, was covered with coagulated blood, and contained also serum. The other three were not so much advanced, but all contained coagulated blood, which might be separated from the sides of the cavity."

"The uterus of a Sow, sixteen days gone.

"The foetus was formed, and its purse-formed membrane, which was above a foot long in some. This membrane, with the foetus nearly in the middle, between each end, lay nearly their whole length in the cavity of the uterus, like a tape-worm in the intestines. Through the whole course of the uterus was a white mucus almost like cream ; and where the foetus lay this was most in quantity.

"In two other Sows, that were only allowed to go ten days, I could not observe any change whatever ; and there was none of the mucus to be found in either uterus."—*Hunterian Manuscript*.



3534. A section of one of the horns of apparently the same uterus as the preceding preparation ; it is laid open longitudinally, and exhibits the same appearances ; the colour of the injection has been altered from the same cause.
3535. A similar preparation, in which the colour of the injection is better preserved. The membranes of the elongated filamentary ovum can be more clearly discerned in this preparation ; they have not received any injection, nor contracted any adhesion to the uterine parietes.
3536. A similar preparation, showing a greater thickening and more irregular rugosity of the lining membrane of the uterus.
3537. A transverse section of the horn of the uterus of a Sow, showing the cavity completely occupied by opposite folds of the lining membrane, which are supported by an abundance of sub-mucous cellular tissue, and come into contact with each other at the centre of the tube.
3538. A foetus about fifteen lines in length, with part of its membranes, of a Sow : it is exposed by the reflection of the chorion and amnion from its dorsal aspect ; the chorion and allantois are laid open longitudinally at the opposite side : the infundibuliform expansion of the urachus at the distal extremity of the umbilical cord is thus exposed, and a bristle is inserted into it : one of the duplicatures of the allantois, extending from its embryonic neck or commencement to the opposite part of the chorion, is here exhibited : although uninjected, the vessels of the chorion are very conspicuous ; the vitellicle or vesicula umbilicalis is not exposed.
3539. A foetal Hog, two inches nine lines in length, with a portion of its membranes : a section is removed from the chorion and allantois ; the cavity of the amnios has been laid open laterally, and a portion of it has been reflected downwards, together with the layer of allantois adhering to it ; the foetus is displaced from the amniotic cavity, by which is exposed the short and straight umbilical cord, and the orifice of the urachus where it expands into the allantois ; a bristle is passed into this aperture. An injection has been thrown into the foetal vessels and into those of its membranes by the hypogastric arteries ; the vascularity of the short villi on

the exterior surface of the chorion is thus displayed: numerous subcircular uninjected spots, resembling shallow follicles, varying from half a line to a line in diameter, and scattered somewhat irregularly with intervals of about twice their breadth, may be observed over the whole vascular surface of the chorion; these consist of a plexus of capillaries of the hypogastric vein.

3540. A foetal Hog, about five inches in length, with its membranes partially injected: the amnios is entire; so much of the allantois and chorion is preserved as immediately invests the embryo.
3541. A section of the chorion and allantois of a foetal Hog, injected, but not very minutely, from the hypogastric arteries; it shows the fine exterior villosity of the chorion, and the characteristic subcircular venous plexules, which are here uninjected.
- 3541 A. A small portion of the chorion of a Hog, with the arterial capillaries filled with red, and the venous ones with yellow injection, showing the venous plexules in the centre of each of the subcircular spots.

*Presented by Prof. Eschricht.*

3542. A foetal Hog, with the whole of its membranes, showing the great length of the cylindrical cavity of the chorion, with which the allantois is nearly co-extensive; a section of the chorion has been removed, exposing a part of its cavity, and here the allantois may be readily distinguished in contact with, but not very firmly adherent to the chorion; the membranes have been injected by the hypogastric arteries, and the uninjected venous plexules described in a previous preparation are very conspicuous in the form of white spots scattered over the surface of the chorion; the original colour of the injection is lost in this preparation, as in No. 3534.
3543. A section of the horn of the uterus which contained the previous foetus, minutely injected by the uterine arteries and inverted; the small spots remain uninjected, which correspond in form, number and position with those formed by venous plexules of the chorion; they probably consist of corresponding plexuses of the uterine veins; the intervening vascular surface supplied by the capillaries of the uterine arteries presents a fine

reticular structure, corresponding with the fine vascular villosities which represent, or hold the place of, a placenta in the foetal chorion: from this disposition of the arterial and venous capillaries of both the uterine and foetal circulations it may be reasonably conjectured, that the nutrition of the embryo is effected principally at the points of contact of the foetal with the maternal venous capillaries, whilst the respiratory processes take place at the surface of contact between the foetal and maternal arterial capillaries.

3544. A transverse section of the same uterus, slit open, and exhibiting, from the superior brilliancy of the injection, more clearly the same appearances as in the preceding preparation.
3545. The ovarium, ovarian capsule, and oviduct of a Sow, described in the Manuscript Catalogue as having done breeding: the surface of the ovarium is here rather more minutely lobulated than in the previous specimens, and traces of small round cicatrices, from which impregnated ova have previously escaped, are very numerous; a section has been removed from one of the ovisacs, and its contents taken away; the natural relative position of the ovarium to the peritoneal pouch supporting the pavilion is well shown. This preparation may have belonged to one of the Sows which were the subjects of the subjoined experiments, "to determine the effect of extirpating one ovarium upon the number of young produced\*."

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\* "In all animals of distinct sex, the females, those of the Bird-kind excepted, have, I believe, two ovaria, and of course the oviducts are in pairs.

"By distinct sex I mean when the parts destined to the purposes of generation are of two kinds, each kind appropriated to an individual of each species, distinguished by the appellation of male and female, and equally necessary to the propagation of the animal. The testicles, with their appendages, constitute the male; the ovaria, and their appendages, the female sex.

"As the ovaria are the organs which, on the part of the female, furnish what is necessary towards the production of the third, or young animal, and as females appear to have a limited portion of the middle stage of life allotted for that purpose, it becomes a question, whether those organs are worn out by repeated acts of propagation, or whether there is not a natural and constitutional period to that power on their part, even if such power has never been exerted? If we consider this subject in every view, taking the human species as an example, we shall discover that circumstances, either local or constitutional, may be capable of extinguishing in the female the faculty of propagation. Thus we



3546. The ovaria, oviducts, and uterus bicornis of an Ass (*Equus Asinus*, LINN.), at apparently a brief period after impregnation. Both ovaria are bisected; in one of these a large cavity is exposed, the irregular internal surface of which is stained with particles of extravasated injection; this is the ovisac from which the last impregnated ovum has escaped; near it is a previously vacated ovisac, with its cavity almost obliterated by the centripetal

may observe when a woman begins to breed at an early period, as at fifteen, and has her children fast, that she seldom breeds longer than the age of thirty or thirty-five; therefore we may suppose, either that the parts are then worn out, or that the breeding constitution is over. If a woman begins later, as at twenty or twenty-five, she may continue to breed to the age of forty or more; and there are, now and then, instances of women, who, not having conceived before, have had children as late in life as at fifty years or upwards. After that period few women breed, even though they should not have bred before; therefore, there must be a natural period to the power of conception. A similar stop to propagation may likewise take place in other classes of animals, probably in the female of every class, the period varying according to circumstances; but still we are not enabled to determine how far it depends on any particular property of the constitution, or of the ovarium alone.

“As the female, in most classes of animals, has two ovaria, I imagined, that by removing one it might be possible to determine how far their actions were reciprocally influenced by each other, from the changes which by comparison might be observed to take place, either by the breeding period being shortened, or perhaps, in those animals whose nature it is to bring forth more than one at a time, by the number produced at each birth being diminished.

“There are two views in which this subject may be considered. The first, that the ovaria, when properly employed, may be bodies determined and unalterable respecting the number of young to be produced. In this case we can readily imagine, that, when one ovarium is removed, the other may be capable of producing its determined number in two different ways: one, when the remaining ovarium, not influenced by the loss of the other, will produce its allotted number, and in the same time; the other, when affected by the loss, yet the constitution demanding the same number of young each time of breeding, as if there were still two ovaria, it must furnish double the number it would have been required to supply, had both been allowed to remain, but must consequently cease from the performance of its function in half the time. The second view of the subject is by supposing, that there is not originally any fixed number which the ovarium must produce, but that the number is increased or diminished according to circumstances; that it is rather the constitution at large that determines the number; and that, if one ovarium is removed, the other will be called upon by the constitution to perform the operations of both, by which means the animal should produce, with one ovarium, the same number of young as would have been produced if both had remained.

“With an intention to ascertain those points, as far as I could, I was led to make the following experiment; and for that purpose gave pigs a preference to any other animal, as being easily managed, producing several at a litter, and breeding perfectly well under the confinement necessary for experiments. I selected two females of the same colour and size, and likewise a boar-pig, all of the same farrow; and having removed an ovarium from one of the females, I cut a slit in one ear, to

growth of the firm vascular or parenchymatous tissue of the proper tunic of the ovisac. A bristle is inserted into the abdominal aperture of the Fallopian tube; the uterus is laid open, exhibiting the angular folds or processes of the vascular lining membrane.

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distinguish it from the other: they were well fed and kept warm, that there might be no impediment to their breeding; and whenever they farrowed, their pigs were taken away exactly at the same age.

“About the beginning of the year 1779 they both took the boar; the one which had been spayed, earlier than the perfect female. The distance of time, however, was not great, and they continued breeding at nearly the same times. The spayed animal continued to breed till September 1783, when she was six years old, which was a space of more than four years. In that time she had eight farrows; but did not take the boar afterwards, and had in all seventy-six pigs. The perfect one continued breeding till December 1785, when she was about eight years old, a period of almost six years, in which time she had thirteen farrows, and had in all one hundred and sixty-two pigs; after this time she did not breed: I kept her till November 1786.—

—“The perfect animal bred till she was eight years of age; and if conception depended on the ovaria, we might have expected that she would bring forth double the number at each birth; or, if not, that she would continue breeding for double the time. We indeed find her producing ten more than double the number of the imperfect animal, although she had not double the number of farrows; but this may, perhaps, be explained by observing that the number of young increased as the female grew older, and the perfect sow continued to breed much longer than the other.

“From a circumstance mentioned in the course of this experiment it appears, that the desire for the male continues after the power of breeding is exhausted in the female; and therefore does not altogether depend on the powers of the ovaria to propagate, although it may probably be influenced by the existence of such parts.

“If these observations should be considered as depending on a single experiment, from which alone it is not justifiable to draw conclusions, I have only to add, that the difference in the number of pigs produced by each was greater than can be justly imputed to accident, and is a circumstance certainly in favour of the universality of the principle I wished to ascertain\*.

“From this experiment it seems most probable, that the ovaria are from the beginning destined to produce a fixed number, beyond which they cannot go, although circumstances may tend to diminish that number; but that the constitution at large has no power of giving to one ovarium the power of propagating equal to both; for in the present experiment, the animal with one ovarium produced ten pigs less than half the number brought forth by the sow with both ovaria. But that the constitution has so far a power of influencing one ovarium, as to make it produce its number in a less time than would probably have been the case if both ovaria had been preserved, is to be inferred from the above-recited experiment.”—*Animal Economy*, 4<sup>o</sup>, 2<sup>nd</sup> ed. p. 157.

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\* “It may be thought by some, that I should have repeated this experiment; but an annual expense of twenty pounds for ten years, and the necessary attention to make the experiment complete, will be a sufficient reason for my not having done it.”

3547. The oviduct and contiguous part of the horn of the uterus of an Ass, injected; a bristle is inserted into the pavilion, and its relation to the ovarian capsule is well displayed.
3548. The right ovarium and oviduct of a Mare (*Equus Caballus*, LINN.): the ovary is bisected, and two large ovisacs are thus laid open; in one of these the lining membrane formed by the ovarian vesicle is reflected from the external vascular substance or proper tunic of the ovisac, which is attached to the ordinary cellular stroma of the ovary: a bristle is inserted into the abdominal or ovarian aperture of the oviduct, and the folds of the pavilion, which radiate subspirally from this aperture, are well displayed.
3549. The oviducal extremity of the horn of a uterus of the same Mare, showing the point of communication with the oviduct or Fallopian tube, into the termination of which a bristle is passed. The lining membrane of the uterus is minutely injected.
3550. The left ovary, oviduct, and contiguous extremity of the uterine horn of the same Mare; the ovary is bisected, showing a recent and an ancient corpus luteum, and likewise a large ovisac lined by the ovarian vesicle: bristles are inserted into both the apertures of the Fallopian tube. The recent corpus luteum in this preparation, like the largest ovisac of the opposite ovarium, is situated at that part of the surface of the ovarium to which the pavilion is attached.
3551. An embryo Foal, with its membranes; it is described in the Hunterian original Manuscript Catalogue as being a month old.
3552. A foetal Foal, about eight inches in length, with its membranes injected, showing the great vascularity and diffused villosity of the chorion, which villosity here, as in the Sow, performs the office of a placenta.
3553. A section of the chorion and allantois, or the so-called 'exochorion' and 'endochorion', of the foetus of an Ass (*Equus asinus*, LINN.): the chorion is distinguished by the clusters of short vascular villosities, which project from its external surface; the allantois is a thin, smooth, transparent, and slightly vascular membrane; the tortuous hypogastric arteries



and veins may be observed to ramify in the interspace between these membranes.

3554. A similar preparation.

3555. A similar preparation of the chorion and allantois of a foetal Foal, showing a more vascular portion of the allantois.

3556. A section of the chorion and allantois of a foetal Foal, showing portions of the tortuous hypogastric vessels.

3557. A similar preparation, showing a part of the chorion where the villousities are not developed.

3558. A section of the umbilical cord of a Foal, showing the minute filiform processes which project from the surface of the amnion covering that part\*.

3558 A. A portion of the inspissated matter of the allantoic liquor of a Foal. This substance is found of various forms and sizes in the cavity of the allantois, generally free, but sometimes attached by a pedicle to that membrane: it was termed by ancient authors 'hippomanes,' and was erroneously supposed to be attached to the head, or to be dropped from the mouth of the new-born foal. *Presented by Mr. Boulton.*

3558 B. The foetus of an Elephant (*Elephas Indicus*, CUV.), at about the middle of the period of uterine gestation, which is twenty-two months.

*Presented by David T. Morton, Esq., M.R.C.S.*

3559. A foetus of a Walrus (*Trichechus Rosmarus*, LINN.), between two and three inches in length: the papillæ supporting the orifices through which the labial bristles are to emerge are very obvious in the broad obtuse extremity of the upper jaw; the five digits and their ungual processes are distinctly developed on each of the four palmated extremities; the abdomen is laid open; and the numerous convolutions of the small intestine are displayed; the amnios which is reflected upon the umbilical cord is smooth.

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[\* The period of gestation of the Mare is eleven calendar months: the Ass brings forth in the eleventh month.]

3560. A fœtus of a Walrus, five inches in length: the palpebræ are completed, but are closed by a continuation of the epithelium over their commissure; the minute foramen of the meatus auditorius is also closed, it forms a small projection about half an inch behind the commissure of the eyelids; the nostrils present the form of linear crescentic fissures, having their convexities turned towards each other; the labial bristles are beginning to be developed on the broad obtuse termination of the upper jaw: a little below the umbilicus may be observed the orifice of the prepuce.
3561. A fœtus of the Walrus, seven inches in length.
3562. A section of the impregnated uterus of a Cat (*Felis Catus*, LINN.)\*, with a fœtal kitten, its placenta and membranes; a portion of uterus is laid open, and the fœtus, with its membranes and placenta, is exposed: the placenta consists of a thin lobulated layer of vascular substance, which surrounds the middle part of the body of the fœtus in the form of a broad circular band or hoop; it has here been divided, together with the uterus, and its fœtal surface is shown; the vessels of the uterus and of the maternal portion of the placenta have been injected; the chorion is laid open, and the fœtus is seen enclosed within the thin transparent amnios.
3563. A section of the impregnated uterus and fœtal membranes of a Cat; the amnios is removed with the fœtus; the allantois is seen expanding from the uterine extremity of the umbilical cord upon the chorion, forming broad duplicatures inclosing the hypogastric or umbilical vessels which lie upon its outside; the trunks of these vessels are situated at the free margin of the allantoic folds, and at the opposite edge of the folds the two layers of the allantois separate from each other to spread over the chorion, with which they cohere; one extremity of the slender, elongated, fusiform vitellicle or umbilical sac may be discerned, but it is not exposed by dissection. The lobulated fœtal surface of the placenta is well seen, and the maternal portion of the placenta is injected from the uterine vessels.

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[\* The period of gestation in the Cat is fifty-six days.]

3564. A transverse section of the membranes of a foetal Cat, including the whole of the annular placenta, of which the uterine portion, partially injected, is here displayed.
3565. A transverse section of the uterus, with the adherent portion of the placenta of a Cat; the foetal and maternal portions of the placenta are partially separated from each other.
3566. A small section of the placenta, and the continuous chorion and allantois of a foetal Cat.
- 3566 A. The female organs, with the urinary bladder and pelvis of a pregnant Cat; each horn of the uterus contains two foetuses; one of these has been reflected with its surrounding amnios from the chorionic bag, and the fold of the allantois accompanying the hypogastric vessels in their course towards the placenta is likewise shown: the lobulated foetal surface of the placenta is here exposed; the foetus is about two inches in length. The contiguous foetus with its amnios is partially exposed by a longitudinal section of the uterus and placenta, of which a portion of the uterine surface is shown. The two foetuses in the opposite horn of the uterus are surrounded each by its annular placenta, which is entire; the orifices of many vessels are conspicuous upon their uterine surface. All the parts are minutely injected by the uterine vessels.

*Prepared by Mr. Clift.*

3567. The ovarium, Fallopian tube and corresponding extremity of the horn of the uterus of a Bitch (*Canis familiaris*, LINN.)\*; one half of the peritoneal sac, which encloses the ovarium and the fimbriated extremity of the Fallopian tube, has been dissected away; the course of the Fallopian tube around the circumference of the sac is indicated by bristles; the parts have been injected, and sections have been removed from the projecting lobes of the ovarium: the uterine horn is laid open, showing the longitudinal folds of its lining membrane.
3568. A section of the ovarium and of the corresponding horn of the uterus, with one of the embryos and its membranes, of a Bitch, killed one month

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[\* The period of gestation in the Bitch is sixty-three days.]



after having taken the dog. The portion of the uterus is laid open, showing the commencing development of the maternal portion of the placenta; the inner surface of the uterus here presents the condition of a layer of finely reticular membrane, the reticulations being formed by the orifices of minute follicles, closely aggregated in the interspaces of larger follicles, which are scattered over this surface at intervals of between half a line and two lines. The foetus and its membranes lie at the bottom of the bottle; the preparation for the foetal placenta is in like manner going on in the chorion in the development of delicate and minutely branched villous processes. Three corpora lutea are exposed in vertical section on the cut surface of the ovarium; the vascular, thickened and parenchymatoid tunic of the ovisac has extended its folds to near the centre of the vacated cavity, which now presents the form of a radiated fissure.

3569. A section of the uterus of probably the same pregnant Bitch, exhibiting the modification of the lining membrane of the cavity where it is about to form the uterine placenta: the follicular orifices of the placental membrane at this stage of its development present a diameter of between the one-fifth and a half of a line; the surface at the interspaces of these follicles is minutely reticulated: the parts have been minutely injected.
3570. A similar preparation.
3571. The ovarium, oviduct, and a section of one of the horns of the uterus of a pregnant Bitch, containing a foetus five inches and a half in length, with its membranes and placenta: the chorion, allantois and amnios have been laid open, and the greater part of the foetal placenta has been separated from the maternal portion; the placenta here, as in the Cat, presents the form of a thin, broad, annular band.
3572. The foetus of a Hyæna, eight inches in length; the whole of the cuticle has been removed.
3573. The posterior half of a pregnant Mole (*Talpa vulgaris*, BRISS.)\*, with

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[\* The period of gestation is at least two months: the young are usually brought forth in April.]

the uterus and three fœtuses, each about half an inch in length, exposed *in situ*: the ovarium is contained in a thin and transparent peritoneal capsule, around which the oviduct may be observed passing in the form of an opaque, white, narrow band: the uterine dilatation next the left ovarium is left open, and the fœtus is exposed inclosed in its membranes; the other uterine dilatations are left entire; they resemble blind pouches developed from one side of the uterine tube.

3574. The posterior extremity of the trunk of a pregnant Mole, with the uterus and five fœtuses displayed *in situ*; one of the dilated chambers of the left uterine horn is laid open, and the fœtus is exposed with its membranes: the placenta is a spongy vascular substance in the form of an oblong flat band, with its long axis parallel to that of the fœtus. One of the uterine chambers with the corresponding chorionic sac is laid open in the right horn of the uterus, and the fœtus is displaced.

3575. The female organs of a pregnant Mole with four fœtuses, each one inch and a quarter in length; one of these is exposed *in situ* in the uterine sac, two others hang suspended by their membranes and the placentæ from the parietes of the uterus: in the lower of these embryos the fœtal placenta is partly separated from the maternal portion, showing the fine areolar structure of the latter, which receives the fœtal placental filaments: the maternal placenta is minutely injected, but no portion of injection has passed into those fœtal filaments which are here exposed: the capacity of the chorion is very little larger than the fœtus which it contains. In the embryo which has been displaced from the chorionic sac the short umbilical cord and the characteristic form of the short and strong fossorial anterior extremities may be discerned: the external apertures of the eyes and ears are completely closed. The canal leading from the uterine horns to the external opening of the vagina is laid open, showing the absence of any os tincae dividing the uterus from the vagina: a bristle is passed into the urethra, which is continued through the perforated clitoris. The peculiar position of the vagina of the Mole, on the outside of the pelvis, is well displayed in No. 2810: by this modification the contracted pelvis offers no impediment to parturition.

3576. The female organs of a pregnant Hedgehog (*Erinaceus europæus*, LINN.)\*. Four fœtuses have been developed in the right horn and two in the left horn of this uterus, and have attained the length of half an inch; they are severally inclosed in a cup-shaped placenta at this period of their development; the whole of one of these placentæ is exposed attached to the inner surface of the uterine dilatation by a small part of its circumference: the embryo with its membranes is visible through the circular aperture at the opposite side of the placenta. Two of the embryos with their membranes and placentæ have been detached and lie at the bottom of the bottle.
- 3576 A. The pelvis, tail, and part of the hind extremity, with the rectum, bladder, and generative organs of a pregnant Hedgehog, at nearly the full period of uterine gestation: two embryos with their membranes and placentæ are exposed in the right horn of the uterus; the cup-shaped placenta, as seen in the preceding preparation, would appear to have been dilated and flattened by the growth of the fœtus, and converted into the form of a subcircular, thin, shallow disk, with its concavity applied to the back of the embryo and the central part of its convex surface attached to the uterus; upon this surface, where it has been detached, may be seen the wide orifices of several uterine veins, by which the uterine portion of the placenta has been injected. The chorion, allantois and amnios have been reflected from the head and anterior part of the body of one of these embryos. *Mus. Langstaff.*
3577. A fœtal Hedgehog, near the conclusion of gestation; its spines are just beginning to protrude through the dorsal integument; they are soft and flexible in the new-born animal, but become hard in the course of a day or two.
3578. The impregnated uterus of a large frugivorous Bat (*Pteropus*, Cuv.); the horn, or division of the uterus which contained the fœtus, forms one large cavity in common with the corpus uteri; the unimpregnated horn projects like a small appendage from one side of the dilated fœti-

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[\* The period of gestation in the Hedgehog is supposed to be ten weeks: it usually brings forth in June.]



gerous sac; the chorion is thin and transparent, and is torn open so as to exhibit a part of the embryo, which is far advanced in development: the placenta is a single, subcircular, flattened body, slightly convex towards the uterus, and presenting a flat surface next the fœtus. A bristle is passed through the os tinæ into the unimpregnated uterine horn.

3579. A fœtus of apparently the same species of Bat, with the chorion and placenta appended to the straight and short umbilical cord: the delicate branched villi, which give a flocculent structure to the fœtal placenta, are beautifully exhibited in this preparation.

3580. The impregnated uterus, containing, as usual in the *Cheiroptera*, a single fœtus and its membranes of a large frugivorous Bat (*Pteropus*, Cuv.). The fœtus is farther advanced in development than in the preceding specimens; the placenta is attached to the uterus by only a small part of its convex surface.

3581. The fœtus, with its circular disciform placenta, and the contiguous portion of the chorion of a *Pteropus*: the maternal and fœtal portions of the placenta are preserved in mutual apposition in this preparation.

3581 A. The fœtus of a flying Macaoco (*Galeopithecus*, Cuv.).

*Presented by Hugh Cuming, Esq., F.Z.S.*

3582. The fœtus of a Lemur at the conclusion of gestation.

3583. A section of the chorion and amnios, with the bilobed placenta and umbilical cord of a Monkey (*Macacus Rhesus*, Cuv.). Red injection has been thrown into the umbilical arteries of the cord: portions of the deciduous membrane remain attached to the outer surface of the placenta and chorion, and on the same surface of the placenta may be observed several orifices of uterine veins: a section has been removed from the smaller lobe, and the cut surfaces exhibit a mixed cellular and villous or filamentary structure. The filaments include the long capillary loops of the fœtal vessels; but instead of hanging freely in corresponding cavities of the maternal placenta, they are connected with the fine cellular structure which receives the blood from the uterine arteries.

3584. The angular section of the placenta and membranes removed from the preceding preparation: a bristle is inserted into a fissure of the uterine surface of this portion of placenta, below which is shown a uterine vein emerging from that surface, two lines in length, compressed, but provided with distinct and proper parietes, which are stronger than those of the veins of the uterine placenta in the human subject: below this vein, and nearer the margin of the section, another uterine vein leading into the substance of the placenta is exposed; its canal is laid open: the decidua, which forms a denser membrane than in the Human subject, is reflected from part of the uterine surface of this preparation, and also from the chorion, a portion of which has in like manner been separated from the amnios; a thin layer of apparently slightly-condensed cellular substance adheres in part to the chorion, in part to the amnios; it may be the remains of the vascular layer of the allantois.

3585. The foetus to which the preceding placenta was attached\*.

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\* Nos. 3583, 3584 and 3585 are the subjects of the following observations by Mr. Hunter:—

“Monkeys always copulate backwards: this is performed sometimes when the female is standing on all fours, and at other times the male brings her between his thighs when he is sitting, holding her with his fore paws.

“The female has her regular periods for the male, but she has commonly too much complaisance ever to refuse him. They carry this still further, for they receive the male when with young, even when pretty far gone; at least this was the case with the one of which I am going to give an account.

“A female Monkey, belonging to Mr. Endersbay, in the summer of 1782, had frequently taken the male. The keeper observed that after the 21st of June she became less lively than usual, although it was not suspected that she had conceived; but some time after, appearing to be bigger in the belly, it created a suspicion of her being with young. Great attention was paid to her, and great care was taken of her. She went on gradually increasing in size; and at last something was observed moving in her belly at particular times, and the motion could even be felt through the abdominal muscles. She became indolent, and did not like to leap or perform her usual feats of activity. Towards the latter part of the time they perceived the breast and nipple to have become rather fuller, and that a kind of water could be squeezed out at the nipple. Some time before she brought forth she became red about the hips and posteriors, which redness extended to the inside of the thighs. It being now certain that she was with young, I desired that she might be particularly attended to when there were signs of approaching delivery, both on her own account and that of the young one, and requested that the afterbirth might be carefully preserved, as that part would assist to ascertain the mode of uterine

[The remaining preparations in the present Series are all from the human subject.]

3586. The ovarium and the ovarian extremity of the oviduct, or Fallopian tube, showing the relative position of the pavilion, or fimbriated extremity of

gestation. These directions were attentively followed: and when in labour it was observed that she had regular pains; that when the young one was partly come into the world she assisted herself with her fore paws, and that it came with the hind parts first. This happened on the 15th of December, 1782, in all about six months after conception; and when she brought forth her young one it showed signs of life, but died immediately, owing probably to the unfavourable mode of its being brought into the world. When delivered she took the young one up, and although it was dead clasped it to her breast.

"The afterbirth was preserved entire, and was perfectly fit for examination. It consisted of placenta, with the membranes and navel-string, which all very much resembled the corresponding parts in the human subject, as will now be described.

"The placenta had the appearance of being divided into two oblong bodies, united by their edges, each terminating in an obtuse point at the other end, which were of course at some little distance from one another.

"It is probable that these two points were placed towards the openings of the Fallopian tubes, where the uterus assumes a form resembling two obtuse horns.

"The two lobes above-mentioned were made up of smaller ones, united closely at their edges, which were more apparent and distinct at some parts than at others. Some of these lobes were divided by fissures which seem to be derived from one centre, while there were others near the edges passing in a different direction, in which fissures are placed veins or sinuses that receive the blood laterally from the lobes. The substance of the placenta seems to be cellular, as in the human subject; this structure allows a communication to be kept up between different parts of each lobe, and the sinuses allowing of a communication between the different lobes of which the placenta is composed, the blood passes into the fissures before it enters the veins; in which respect it differs from the human placenta.

"The arteries from the uterus, on the surface of the placenta, were visible, but too small to be injected; I cannot, therefore, say how they terminated in the placenta.

"The principal veins arose in general from the fissures beginning from the surface, as in the human placenta; but besides these there were other small ones, all which we may suppose pass through the decidua and enter the substance of the uterus, most probably in the same way as in the human subject.

"The membranes are the amnios, the chorion, and the membrana decidua. These appear to be much the same as in the human, except that the decidua is considerably thicker, especially where it passes between the uterus and the placenta.

"The navel-string in the Monkey is not proportionally so long as in the human, and is very much and very regularly twisted."—*Animal Economy*, 2nd ed. 4to, p. 177.



the Fallopian tube, to the ovarium, and the aperture of the tube itself, in which a bristle is placed. The ovarium is bisected, showing the adherent serous and fibrous tunics of its capsule and the stroma, or cellular substance, in which the ovarian vesicles and the ova are developed. The ovarian vesicle and ovum are inclosed in an ovisac, which consists of a denser and more vascular substance than the ordinary 'stroma': two of these ovisacs, which, with the ovarian vesicle\*, constitute the so-called 'Graafian follicle' or 'vesicle,' are laid open, showing the condensed stroma forming the proper tunic of the ovisac, and the collapsed ovarian vesicle and its granular lining membrane and contents, which may include the true ovum and its immediate investment, or the 'tunica granulosa;' but the contents of the ovisac require for demonstration the aid of the microscope†.

- 3587. A similar preparation from a pregnant uterus, showing the elongated form of the ovarium and the shortening of the broad ligament, due to the encroachment of the expanding uterus between the layers of the peritoneum which compose that 'ligament.'
- 3588. A similar preparation from a Woman who had borne eleven children: a section has been removed from the ovarium; the parts have been injected.
- 3589. One of the oviducts or Fallopian tubes of a pregnant uterus, laid open to show the wavy longitudinal folds of the lining membrane.
- 3590. The left ovary, oviduct, and corresponding half of the uterus of a young Woman, supposed to have been in the first month of her pregnancy: a thin slice has been removed from the middle of the ovary, and the remaining portions are divaricated, showing two lateral moieties of the 'corpus luteum'; it is of large size, occupying nearly one-third of the entire

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\* 'Internal layer of the Graafian vesicle' of Prof. Baer, 'chorion' of Prof. Wagner, and 'ovisac' of Dr. Barry.

† The student is referred for the best and clearest description and figures of the ovarian ovum, and ovarian vesicle in the Vertebrate animals generally, and the Mammalia in particular, to the masterly Papers by Dr. Martin Barry in the Philosophical Transactions for the years 1838 and 1839.

ovarium ; it consists of the altered and thickened proper membrane of the ovisac, the folds of which have become blended together, and have nearly obliterated the original cavity of the ovisac ; a slight trace of this cavity may be seen on one side of the section of the ovarium : the corpus luteum is adherent by its external surface to the cellular stroma of the ovary, and rests upon a very vascular substance at the base of the ovarium : the cicatrix by which the impregnated ovum escaped is very distinctly shown on that side of the corpus luteum which is nearest the pavilion : on the opposite side, in the substance of the ovarium, may be observed a smaller and apparently older 'corpus luteum' : several unimpregnated ovisacs or Graafian vesicles are cut across, in some of which may be seen the ovarian vesicle and its contents. The Fallopian tube has been laid open, and the cavity of the portion of the uterus here preserved is exposed : a fibrinous substance, representing the 'decidua vera,' apparently in close organic connexion with the inner surface of the uterus, but which has received very little injection, projects into the uterine cavity : the free surface of this substance is smooth.

3591. The right ovarium, oviduct, and corresponding moiety of the uterus of the same young Woman ; the ovarium is bisected, exhibiting the ovisacs imbedded in the stroma in their unimpregnated state, of various sizes, the largest being near the periphery of the ovarium. In the cavity of this portion of the uterus, a thick layer of the same fibrinous and slightly vascular substance is shown, extending further into the cervix uteri, where its extremity is jagged and irregular ; some vessels may be distinctly traced, continuing from the parietes of the uterus into this modification of the 'membrana decidua.'
3592. A thin slice from the middle of the posterior wall of the same uterus, in which the continuity of the fibrinous substance with the lining membrane of the uterus is very distinctly shown, as also its comparatively slight vascularity.

[The three preceding preparations form the subjects of the subjoined account, by Mr. Hunter, of the appearances in the dissection of

a young Woman who poisoned herself in the first month of her pregnancy\*.]

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\* "The Case of a Young Woman who poisoned herself in the first month of her pregnancy. By Thomas Ogle, Surgeon, Great Russell Street, Bloomsbury. To which is added an account of the appearances after death, by the late John Hunter\*.

"Mary Hunt, servant to a gentleman in Charlotte Street, Bedford Square, twenty-five years of age, had for some time shown a partiality for one of the footmen in the same family. She became all at once exceedingly dejected, which was supposed to proceed from his neglecting her; and on Thursday, the 19th of April, at twelve o'clock at night, took half an ounce of white arsenic, and immediately afterwards drank a quart of wine: about one o'clock she had so much pain in her stomach as to be obliged to call for assistance.

"The symptoms were excruciating pain in the stomach, sickness, vomiting, excessive thirst, and a small tremulous pulse; these were followed by pain in the bowels, and several purging stools.

"She drank brandy and water, wine and water, and several quarts of plain water, to relieve the thirst and ease the pain. Some hours after taking the arsenic she became easier, expressed a desire to be left alone, being inclined to sleep, and remained several hours in a comatose or dosing state, from which she did not recover, and died about one o'clock on Friday, thirteen hours after taking the arsenic.

"Upon inspecting the body after death there were found the following appearances:—

"In the cavity of the abdomen there was an appearance of the effects of slight inflammation on the peritoneal coat of the small intestines.

"The stomach contained a greenish fluid, with a curdy substance in it, in all amounting to about twelve ounces.

"On the internal surface of the great curvature near the cardia, a portion of the villous coat, about the size of a crown-piece, was partly destroyed, and of a dark red colour, with a regularly defined edge, and some of the arsenic adhering to different parts of its surface. The rest of the stomach was in a natural state. This appearance in the stomach was an effect produced by the arsenic.

"The uterus was a little enlarged, and had vessels unusually loaded with red blood.

"There was an uncommon quantity of blood in the vessels of the ovaria and Fallopian tubes, but principally in those of the ovarium, and morsus diaboli, on the left side.

"The organs of generation being carefully removed, and both ovaria being split open, there was found in the left a corpus luteum.

"It was evident, from this circumstance, that conception had taken place, which led to an inquiry respecting the last appearance of her menses, which appeared by the evidence of the family to have been a little more than a month before her death.

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[\* Originally published in the Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. ii. p. 63. Communicated to the Society by Everard Home, and read August 5th, 1794.]



3593. The ovaria, oviducts and uterus, apparently a short time after impregnation: the right ovarium is bisected, exposing a large 'corpus luteum,' half of which has been dissected out; and the smooth surface of the ovarian stroma, which was in contact with its external surface, is dis-

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" With the dread upon her mind of being with child, the usual period of menstruation had hardly elapsed without its appearing, which confirmed her suspicions, before she in a fit of despair put an end to her life.

" From this evidence, the period of conception could not exceed a month, and probably was much within that time.

" As it was interesting to have the parts accurately examined, to see what information might be acquired respecting the fœtus at so early a period, they were given to Mr. Hunter for that purpose, whose observations upon them are contained in the following account:—

" The arteries of the uterus were injected, and the smaller vessels were filled to so great a degree of minuteness, that the whole surface became extremely red.

" The cervix uteri and os tinæ were of their natural size; but the body, or that portion of the uterus next the fundus, was a little enlarged, and more prominent externally in the middle. The spermatc vessels were also enlarged.

" On cutting into the substance of the uterus, it had more of a laminated structure than in the unimpregnated state: this appearance of lamellæ appeared upon examination to be formed by veins somewhat enlarged, compressed, and transversely divided. The uterus was unusually soft in texture, and terminated on the internal surface in a pulpy substance.

" The blood-vessels of the uterus passed into and ramified upon this pulpy substance, which was continued across at the cervix uteri, so as to make the cavity of the uterus a circumscribed bag; and at this part the pulpy substance was so thin as to resemble the retina.

" This cavity had a smooth but irregular internal surface, and the pulpy substance upon which it was formed was evidently blood coagulated, and varied in its thickness in different parts. Upon a longitudinal section of the uterus, the posterior part of the coagulum, which was the thickest, was nearly half an inch; where it terminated towards the cervix it was pendulous and unattached. There were also several loose processes, all turned towards the cervix, one of them very thin, as broad as a silver penny, and only attached by one edge to the fundus near the opening of the right Fallopian tube.

" On slitting open the Fallopian tubes, the coagulum was found to pass some way into them, and to extend more than half an inch on the left side, which had the corpus luteum. The coagulum was thickest at the orifice of the tube, and there adhered to the inner surface for the eighth part of an inch, beyond which it became smaller, and terminated in a point. In the left tube the coagulum was in two places coiled or folded upon itself, as if thrown back by the action of the tube. The portions of the coagulum at the orifices of the tubes were hollow.

" When the inner surface of the cavity of the uterus was examined with a magnifying-glass, it was found extremely vascular, and dotted with innumerable whitish spots, too small to be seen by the naked eye.

" In the examination of this uterus and Fallopian tubes, as Mr. Hunter's chief object was the detection

played; the remaining half of the corpus luteum has been irregularly sliced away, but there seems to have been a slight remnant of the original cavity of the ovisac in its centre.

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of the embryo, no precaution was omitted which could be devised to prevent it being overlooked or destroyed.

“The uterus was opened in a bason of clear water, the incision was conducted with great circumspection, and very slowly continued till the whole of the cavity was exposed. Every part of the internal surface was minutely examined with magnifying-glasses; but in no situation was there anything resembling an embryo to be found.

“The presence of a corpus luteum, the enlargement of the uterus, the newly-formed vascular membrane or decidua lining the cavity, and the history of the case, sufficiently prove conception to have taken place; and the embryo being nowhere detected by an examination so accurate, and conducted by an anatomist so skilful in minute investigation, would induce a belief that the fœtus had not been sufficiently advanced to take on a regular form.

“The appearances in the uterus here described, the late Dr. Hunter, in his Lectures, mentioned to have seen at a very early period after impregnation: so far they are not entirely new. The accuracy of the examination renders this case valuable, as it seems to enable us to decide a point hitherto not at all understood,—that certain changes in the uterus not only take place previous to the reception of the fœtus, but that the fœtus does not acquire a visible form for some time after these changes have been made\*.”

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[\* The positive conclusions deduced from this case, viz. that certain changes take place in the uterus within one month after conception, have been confirmed by all those anatomists who have enjoyed similar opportunities of examining the uterine organs within the same period. These changes consist essentially in the effusion of fibrine or coagulable lymph from the villi of the lining membrane of the uterus, which villi also become much elongated and highly vascular; and minute vessels are continued from them into the effused lymph, forming loops or arches in that substance. This process is compared by Hunter, in the above account, to the effusion of lymph consequent on the introduction of an extraneous living part into any of the cavities of the body; and Von Baer, in a recent elaborate description of the uterus of a female, who drowned herself eight days after impregnation, makes the same comparison. Professor Weber, in an examination of the uterus seven days after conception, also speaks of the great vascularity of its inner surface, and describes the villi as consisting of small cylinders placed perpendicularly to the inner surface of the uterus, united by a slimy membrane, and forming together a layer of pale soft substance, from half a line to a line in thickness; whilst in some places the cylinder presented the length of from two to three lines.

With respect to the negative results of Mr. Hunter's examination relative to the reception of the fœtus in the uterus, and “its acquisition of a visible form,” if the product of generation were really expected to have been seen in that state of development which is understood by the terms embryo and fœtus, its presence would most likely be overlooked; since, from the analogy of the dog and rabbit, it probably would have existed merely as a small pellucid vesicle or ovum.—R. O.]

3593 A. The ovaria, oviducts and uterus of a young Woman, who destroyed herself, it was supposed, eight days after impregnation: both ovaria are bisected; the right one contains a corpus luteum, which occupies nearly half the entire substance of the ovarium; its external surface is connected with the stroma ovarii by means of a thin layer of a lax and delicate cellular tissue: the original cavity of the ovisac is quite obliterated, but the substance by means of which this has been effected is of two kinds; the external one, which is the thickened and altered proper tunie of the ovisac, presents a lighter colour and a firmer and more parenchymatous texture than the internal substance, by which the cavity of the ovisac has been finally obliterated: this latter substance presents the appearance of a loose cellular tissue, having its interspaces filled with coagulated albumen or fibrin; it leads to the cicatrix closing the external aperture of the vacated ovisac, and is, as it were, eneroached upon by convex folds or processes of the external substance. In the opposite ovarium are exposed the cavities of the unaltered ovisacs, situated near the periphery of the gland: the posterior parietes of the uterus have been removed, exposing an irregular layer of fibrous flocculent substance attached to its inner surface.

This is the preparation which is figured in the *Philosophical Transactions* for 1817, Pl. VIII., and which is the subject of the subjoined observations\*, by the

*Donor, Sir Everard Home, Bart.*

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\* "Haighton and Cruikshank, by experiments on rabbits, confirmed the opinion of De Graaf<sup>1</sup>, that an ovum is carried from the ovarium into the uterus; but by mistaking the corpus luteum for the effect of impregnation, instead of the substance in which the ovum is formed, which at that time was the generally received opinion, got entangled in theoretical opinions which misled them in their farther inquiries.

"In this state of our knowledge upon this most interesting subject, accident has done what no pre-determined experiments had accomplished,—it has enabled me to detect the ovum in the human uterus. It is so small, that had not the uterus been previously hardened in spirit as well as the ovum itself, it probably would have escaped observation; and after it was found it could not have been identified to be the ovum from which a child was to be produced, had it not been brought under the eye of

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<sup>1</sup> "De Graaf's observations are mentioned in the 7th volume of the *Philosophical Transactions*, p. 4052. In the same volume, p. 4018, Dr. Kerkringius's observations concerning eggs to be found in all sorts of females, are noticed."



3593 B. The female organs and urinary bladder of a young Woman who destroyed herself, it was supposed, in the first month of uterine gestation :

Mr. Bauer, the only person, I may say, in this or any other country, who could so correctly apply to it the powers of the microscope as to determine its form,—could so separate its parts on the field of the microscope as to display its organization, and so delineate what he saw as to convey distinct notions that it was the first rudiments of a child.

“I shall first give a history of the woman’s case from the time of her impregnation, and then detail the appearances that were met with in the uterus and ovaria after death.

“A servant-maid, twenty-one years of age, had been missing from her master’s house, on the 7th of January, 1817, for several hours in the forenoon; she came home in high spirits, said she had bought a pair of corsets and some other parts of dress.

“In the evening she got her fellow-servant to assist her in putting on the corsets, but on lacing them she complained of being sick, and all over unwell; on taking some brandy she recovered a little and went to bed. Next day she was much the same: the period of menstruation had arrived, but it did not come on; and from this time there was a wildness in her manner, and she appeared distressed in her mind. On the 13th she had an epileptic fit attended with delirium, and on the 15th, about ten o’clock in the forenoon, she died.

“After death the uterus showed signs of pregnancy, and from the statement that has been given she appears to have been impregnated on the 7th of January, eight days before her death; for, although she was known to have a lover, there are circumstances to prove that she could not have seen him after that time, nor for many days before.

“The uterus having been hardened in spirit, with the assistance of Mr. Clift I examined the parts. The right ovary had a small torn orifice upon the most prominent part of its external surface; we slit it open in a longitudinal direction, in a line close to the edge of this orifice; the orifice was found to lead to a cavity filled up with coagulated blood, and surrounded by a yellowish organized structure. Upon opening into the cavity of the uterus its inner surface was covered with an exsudation of coagulable lymph; the ovum lay concealed among the long fibres of coagulable lymph near the cervix, and was brought to view by separating them with the point of a needle which I employed in making the search. As soon as it was disentangled it rose up, moving along with the loose ends of the fibres into the spirit by which the parts were covered; it had an oval appearance; one portion of it was quite white, the other semi-transparent; but soon after, being exposed to the spirit, the whole became opaque. The os tincæ was entirely shut up with a strong solid jelly; the two orifices at the angles of the uterus, by which it communicates with the Fallopian tubes, were both pervious.

“As the ovum was so extremely small as to admit of dispute whether it was one or not, I carried it immediately to Kew to Mr. Bauer, who, after examining it, said that it looked like the egg of an insect. His drawings of the ovum and uterus show to what an excellence microscopical observations can be carried, since in so small a particle of animal matter he has pointed out the effects of impregnation even before any part of the vascular system had been formed, and where only the two projecting points within the ovum had been marked out as the future situations of the heart and brain. These two points are still to be distinguished in the ovum in a dried state, and that towards the broadest end is the largest.

“Mr. Bauer’s drawings not only show the changes which take place in the ovary for the purpose

both ovaria are bisected, and in the left one is shown the corpus luteum, which occupies nearly one half of the entire ovarium ; its outer surface

of forming the ova, but also the internal surface of the Fallopian tube at the time the ovum passes along it in its course to the uterus, which I believe has never before been represented.

“The appearances are so clearly shown in the drawings, that it is not necessary to describe them : I shall therefore confine myself to an explanation of their probable uses.

“The dilatation of this tube at a small distance from the fimbriæ appears to be fitted for the reception of the ovum as well as of the semen, and the ovum is probably retained in this situation for several days, to prolong the opportunity of its being impregnated.

“It has been disputed whether the semen ever comes in contact with the ovum, or even arrives at the uterus ; but as Mr. Hunter has proved by experiment that it reaches the uterus<sup>1</sup>, and as there is no impediment to its passage from that organ to the ovarium, it must be admitted that the semen reaches the ovum before impregnation can take place.

“The formation of ova in the ovaria, and their appearing in that organ in succession, joined to the circumstance of animals during the warm season being ready to receive the male once a month, leads to an opinion very contrary to that which is commonly received respecting menstruation. This discharge has been supposed a previous step, preparing the uterus for utero-gestation ; and if a woman has not been impregnated soon after menstruation, it is presumed she may be more fortunate after her next period.

“It is clear, from the case which has been stated, that such periods are totally unconnected with the formation of the ovum, the process of its leaving the ovarium, or its impregnation ; but if impregnation does not take place, such a discharge may be necessary for the relief of parts to which there has been so great a derivation of blood, as the only means of restoring them to their natural state. The uterus in women and the monkey has a more compact form than in other animals, which may explain the circumstance of menstruation being confined to them.

“In proof of menstruation not being necessary to impregnation, I shall mention the following case. A young woman was married before she was seventeen, and although she had never menstruated, became pregnant : four months after her delivery she became pregnant a second time, and four months after the second delivery she was a third time pregnant, but miscarried ; after this she menstruated for the first time, and continued to do so for several periods, and again became pregnant.

“I have given Mr. Bauer’s account of the ovum in his own words, than which none can be more clear or satisfactory.

“On closely examining the subject under the microscope, I found it consisted of membrane, which, considering the extreme minuteness of the subject, is of considerable thickness and consistence, very little transparent, quite smooth, and milk white, forming a kind of bag or pouch of an irregular oval shape, not quite  $\frac{1}{200}$ th parts of an inch in length, and in its middle about  $\frac{9}{200}$ th parts of an inch broad ; on one side it has an elevated ridge or large fold along the whole length, and on the opposite side it

<sup>1</sup> “J. Hunterus canis fœminæ inter coëundum occisæ, uterum aperuit ; quo facto maris semen in ipsum uterum, per saltus intromissum, clare vidit.”



is smooth, and attached to the adjoining stroma ovarii by a thin layer of loose and fine cellular tissue; the cavity of the ovisac is still patent in

is open nearly the whole length, but has no appearance of being torn, the edges of the membrane being smoothly rolled inwards, which gives it much the shape of a little shell of the genus *Voluta*.

“ ‘When laid on glass the membrane admitted easily to be laid open on both sides with the point of a fine camel-hair pencil. When thus opened I found it contained another smaller bag somewhat less than  $\frac{1.8}{200}$ th parts of an inch long, and not quite  $\frac{5}{200}$ th parts of an inch broad, ending at the upper extremity nearly in a point; but the under (lower) extremity was very obtuse or truncate, and in the middle it was slightly contracted, which gave it the appearance of a young seed-capsule of some plants that contain only two seed-kernels.

“ ‘This inner bag consisted of a seemingly very thin, perfectly smooth and glossy membrane which seemed to have considerable strength, as it bore to be rubbed pretty strongly, not only with the camel-hair pencil, but also with the point of a quill; it seemed to be filled with some thick slimy substance, as an impression made on it with the point of the quill remained for a considerable time visible; it contained two round corpuscles, apparently more opaque, and of a yellowish tint; they were not only visible through the transparent membrane, but they swelled the membrane over them, so that the light and shade made them to be distinctly seen; and by slightly pressing the bag with the quill between the two corpuscles, they could be separated to a greater distance from each other, but on putting more moisture upon the subject, they returned quickly to their former position. This little bag was along its whole length, with its back part strongly attached to the outer membrane, at least I could not remove it with the camel-hair pencil, and more force I was afraid to employ.

“ ‘I attempted to open the little bag, if possible, to extract the corpuscles; but on piercing, with the point of a very small needle, the upper extremity, a thick slimy matter like honey came out, and with the membrane adhered to the needle, so that I could no farther proceed; and fearful of spoiling the whole, I gave up the attempt, and left the subject on the glass to dry; but I observed as the spirit and moisture gradually evaporated, so the little bag flattened, and, as if melting, shrunk into the outer membrane and almost disappeared, but in a strong light was still visible in the microscope.

“ ‘When quite dry, its colour changed to a light yellowish brown, and it lay quite loose on the glass, except at the upper extremity, where I attempted to open it; it was strongly glued to the glass, and it required several times to be moistened at that part with water to remove it from the glass.

“ ‘I have now placed it between two pieces of talc in an ivory slider; and in a strong light the two corpuscles may still be seen through a common magnifying-glass.’

“ ‘The drawing of the uterus is of the natural size: the parts are so distinct that no letters of reference appear to be necessary to point them out. The ovum is shown exactly in the spot in which it was discovered, with the appearance which it at that time put on.

“ ‘The drawings of the ovaria and Fallopian tubes are magnified four times, to give a more exact notion than could be otherwise done of the canal through which the ovum passes before it arrives at the cavity of the uterus. The appearance the corpora lutea put on is the most exact representation from nature. In the right ovarium cells remain where former ova had been formed, and one corpus luteum, which is cut through the middle, has made considerable advance in its formation; another



the centre of the corpus luteum: a bristle is passed from it through the aperture by which the impregnated ovum escaped: this cavity is lined by a layer of substance different from, but closely blended with the proper tissue of the corpus luteum, into which prolongations of the central tissue are continued in an irregularly radiated form. The posterior parietes of the uterus are removed, showing the thick layer of fibrinous substance adherent to its inner surface, and analogous to that which is shown

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appears to be in an earlier stage; all the different orifices are the transverse and oblique sections of blood-vessels.

"In the left ovarium, the opening through which the ovum, the subject of the present paper, passed out, is distinctly seen, and the cavity in which it was contained is filled with coagulated blood in a laminated form; behind this the glandular structure of the corpus luteum is readily distinguished, of the form of an irregular oval. Towards the other end of this ovarium is the transverse section of a corpus luteum, not far enough advanced in its growth to have a cavity in which the future ovum is to be generated, the whole having one uniform glandular structure, the general form, like that of the other, being irregularly oval. The orange colour peculiar to the glandular structure of the corpora lutea, which is very bright, and forms their distinguishing character, is not given, as the drawing is intended to be engraved."—*Philosophical Transactions*, 1817, Part I. vol. cvii. p. 252<sup>1</sup>.

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<sup>1</sup> [The notoriety which this case has acquired, and the importance assigned to it in works on Embryology, rendered it desirable to connect with the description of the preparation itself the comments which Sir E. Home has left on record respecting it. It is unnecessary formally to refute that author's opinion that a 'corpus luteum' is a preparatory step to the formation of an ovum, as the evidence of every preparation exhibiting a true 'corpus luteum' in the Hunterian collection goes to prove that it results from a modification of the true ovisac subsequent to the escape of an impregnated ovum. With regard to the immediate and more important subject of the memoir founded on the present preparation, it may be objected, that in the Mammalia, which resemble the human species in the development of the foetus by means of a placental adhesion to the uterus, the ovum, during the period when it remains unattached to the uterus, has presented a translucency and delicacy of its membranes widely different from the structure of the human ovum, as described by Home and Bauer; and even in the ovum of the Ornithorhynchus, exhibited in No. 3460 A, where the chorion is of a denser texture, as might be expected from the affinity of the species to the ovo-viviparous reptiles, it nevertheless, although subjected, as in Sir Everard Home's case, to the action of alcohol, retains a certain degree of transparency: it is highly probable, therefore, that the object submitted by Sir E. Home to Mr. Bauer, for description and delineation, actually was what Mr. Bauer declared it to resemble, viz. the egg of an insect. Mr. Clift, who laid open the uterus in question, and patiently scrutinized the whole of its cavity without detecting any trace of an ovum, still retains the opinion which he originally formed,—that the ovum detected by Sir E. Home in a subsequent scrutiny was deposited in the interval of the examinations by one of the numerous flesh-flies that were buzzing about the table during the whole period of the investigation.—R. O.]

in Nos. 3590, 3591 : in the space inclosed by this substance a second and smaller cavity is contained, formed by a continuation or reflexion of the same fibrinous substance over the thin chorion of the ovum ; this second cavity is laid open by a crucial incision, and the cavity of the chorion is exposed, but no definite trace of an ovum can be discerned in it. The fibrinous layer surrounding the external cavity, and adherent to the uterine parietes, is termed the 'decidua vera,' or uterine decidua ; the second stratum immediately investing the ovum is called the 'decidua reflexa,' or foetal or ovuline decidua ; it is, however, like the first, a production of the uterus : the interspace between these layers of fibrinous substance contains a sanguineous fluid, called the 'perionic fluid', and the cavity is termed the 'perionic cavity' ; the external wall of this cavity, formed by the uterine decidua, presents a reticulate surface.

*Presented by Sir William Blizard, F.R.S.*

3593 c. The ovaria, oviducts, and uterus of a young Woman, who destroyed herself, it is supposed, in the second month of her pregnancy : the left ovarium is bisected through the centre of the corpus luteum, which occupies more than one half of the entire gland : a slight remnant of the original cavity of the ovisac may be observed on one of the cut surfaces of the corpus luteum ; the parietes of this cavity consist of a thin white tissue, firmly adherent to the darker-coloured parenchymatoid substance of the corpus luteum, and sending processes into that substance : a bristle is placed in the abdominal aperture of the corresponding Fallopian tube. The cavity of the uterus is exposed by a vertical section along its posterior part ; the lining membrane of the uterus is protruded by a thickening of the subjacent tissue into the cavity of the uterus ; the cavity of the ovuline decidua is laid open, and a portion of the villous chorion is exposed within it : the embryo, which is stated to have been seven lines in length, has been removed.

*Prepared by Mr. Clift from a specimen presented to him by  
Mr. Satterley, Surgeon, Hastings.*

3594. A section of a gravid uterus at a more advanced stage of pregnancy, when the perionic cavity is obliterated, and the two layers of decidua are con-

fluent, presenting the condition of a loose cellular membrane, uniting the chorion to the inner surface of the uterus.

- 3595. A section of the same uterus, on one side of which the chorion has been slightly separated from the inner surface of the uterus, and the cells of the intervening modified decidua are better displayed ; besides attaching the chorion to the uterus, the decidua now serves to support the foetal vessels in their passage to the foetal membranes.
- 3596. A section of a gravid uterus at the same period of gestation, in which a portion of the chorion is reflected downwards, and the connecting reticulate decidua is divided.
- 3597. A portion of a gravid uterus, the arteries of which have been minutely injected, and a portion of the chorion reflected downwards, to show several arteries passing to it through the cellular decidua ; the oblique canals of the uterine veins through the same decidua are likewise shown.
- 3598. A section of a gravid uterus about the same period, minutely injected both by the arteries and veins ; the amnios, chorion, and two layers of the vascular and cellular decidua are successively reflected from the inner surface of this section.
- 3599. A section of a gravid uterus, with red wax injected into the arteries and yellow wax into the veins ; a portion of the chorion and amnios has been reflected from its inner surface, showing the loose cellular and reticulate structure of the connecting decidua.
- 3600. A similar preparation, but uninjected.
- 3601. A section of the parietes of a gravid uterus, to show the increased thickness of the muscular tissue.
- 3602. A similar preparation.
- 3603. A section of a part of the parietes of a gravid uterus, to which the round and broad ligaments are attached, showing the increased length and strength of these parts in an advanced stage of pregnancy.
- 3604. The uterus at the sixth month of gestation, with the placenta, chorion and amnios attached to its internal surface : a section of the parietes has



been removed, which shows their thickness ; and the uterine veins have been injected, which shows their large size, flattened form, and disposition in the interspaces of the muscular fibres of the uterus. The shortening of the broad ligaments, the approximation of the ovaria and pavilions to the uterus, and the large plexus of uterine veins included in the broad ligaments, are all well demonstrated in this specimen. A section has been removed from the posterior part of the os tinæ, below which the wide and smooth vagina is laid open.

3605. A longitudinal section of the uterus at the seventh month of gestation : red injection has been thrown into the uterine arteries, and yellow injection into the uterine veins ; the disposition, size and form of the uterine venous sinuses are well displayed on the cut edges of this preparation. The placenta, chorion and amnios remain attached to this section : portions of the amnios, chorion and two layers of decidua are successively reflected from part of the inner surface of the uterus ; a portion of the placenta has likewise been detached, so as to expose its uterine surface and the ruptured uterine arteries and veins which remain attached to that surface ; the placenta has received in some places the red injection from the uterine arteries, and in others the yellow injection from the uterine veins ; the foetal vessels have not been injected.
3606. A section of the cervix uteri and os tinæ at the latter period of pregnancy, showing the great development of the glandular structures of these parts, and especially of the obliquely plicated lining membrane and its subjacent cellular tissue at the cervix uteri.
3607. A similar section of a uterus, with a part of the vagina, at a less advanced period ; it shows the longitudinal line from which the oblique valvular plicæ diverge.
3608. A section of the os tinæ and part of the vagina at the period of parturition, showing the vesicular appearance of the surface of the os tinæ, arising from the enlargement of the mucous follicles of that part.
3609. A smaller section of the os tinæ at a similar period, in which the development of its glandular structure is better displayed.

3610. A section of the parietes of a uterus at the close of gestation, showing the large size, number, and plexiform arrangement of the venous sinuses, their oblique channels of inter-communication, and the wide apertures left on the inner surface of the uterus when the reticulate decidua containing the continuation of the uterine veins has been torn away: the veins have been here filled with a dark injection, the uterine arteries with red injection; the ruptured extremities of the arteries on the inner surface of the present section may be observed in general to form a short spiral coil, as described by Hunter in his account of the vascular communication between the uterus and placenta. The preparation exhibits that part of the uterine surface to which the placenta was attached.
3611. A section of the uterus and urinary bladder soon after parturition, showing the almost entire obliteration of the os tincae.
3612. A longitudinal section of the uterus soon after parturition, showing the increased thickness of its parietes produced by the muscular contraction.
3613. A small section of a uterus at the same period, showing the change of form in the uterine veins produced by this contraction; the areae of the veins becoming more open and circular where they are not constricted by the muscular fibres, the latter condition may be observed towards the inner surface of the uterus.
3614. A small section of a uterus soon after delivery, including the part to which the centre of the placenta was attached; a coagulum may be observed projecting from the lacerated orifices of the uterine veins; a small cavity like a sinus leads from the middle of the inner surface here exposed to the external serous membrane of the uterus: a bristle is placed in this cavity, which is evidently a preternatural condition.
3615. A section of a uterus a short time after parturition, but the period is not stated, showing that part of the inner surface of the cavity to which the placenta was attached: it is very irregular.
3616. A longitudinal section of a human uterus soon after parturition; the exact period is not noted.

3617. A longitudinal section of the uterus, vagina and urinary bladder, at a later period after delivery, showing considerable diminution of the size of the uterus by contraction of its cavity and thinning of its parietes: a section has been removed from the ovarium, showing the corpus luteum; it is much diminished in size as compared with those shown in Nos. 3590 and 3593; a white line, which runs along its centre and sends processes into its substance, indicates the situation of the obliterated cavity of the ovisac.
3618. The opposite section of the same parts.
3619. A uterus at a later period after parturition, with the beginning of the vagina laid open.
- 3619 A. The uterus and part of the vagina, minutely injected, of a Woman executed six weeks after parturition; it is laid open longitudinally, showing that all the parts have nearly regained their ordinary dimensions.
- Prepared by Mr. Clift.*
3620. An embryo, four lines in length, with its membranes: the amniotic bag, which is about an inch and a half in diameter, is laid open, exposing the embryo suspended within its cavity by an umbilical cord, one line and a half in length; the whole of the amnios is connected to the external membrane or chorion by a delicate intervening membrane and a fine gelatino-cellular substance; in the interspace of these membranes, and at a short distance from the embryo, may be seen the remains of the vitellicle or 'vesicula umbilicalis'; it is a flattened, subcircular sac, one line and a half in diameter, and is distinguished by its opacity and whiteness. The chorion has developed from the whole of its outer surface the elegant branched villi which characterize it at this period of foetal development. A certain portion of this villous structure remains to be formed into the foetal portion of the placenta, the rest disappears: the present transitory condition of the chorion, and still more the earlier period, when the villi are short, simple and unbranched, offer an interesting analogy to the persistent state of that membrane in some of the lower Mammalia, as the Sow and Mare.



3621. A section of the amnios, chorion, and part of the ovuline decidua or 'decidua reflexa' of an embryo, at apparently the same period of development as the preceding; a portion of the embryo is suspended from the inner surface of the amnios.
3622. A section of the amnios, chorion, and decidua reflexa of an embryo, at about the same period of development: a portion of the amnios has been reflected from the chorion, to show the remains of the vitellicle or 'vesicula umbilicalis' in the interspace of those membranes.
3623. A portion of the amnios, chorion, and ovuline decidua of an embryo, at about the same period of development; a portion of the branched villous processes of the chorion are so exposed as to be conveniently examined by means of a pocket-lens.
3624. A section of the amnios and villous chorion at a corresponding period of embryonic development.
3625. The amnios and villous chorion inverted, at a corresponding period of embryonic development.
3626. A similar preparation.
3627. An embryo between four and five lines in length, inclosed within the cavity of the amnios, from which a great part of the chorion has been dissected; the remains of that membrane exhibit its branched villous processes.
3628. An embryo, five lines in length, suspended by a short and morbidly-attenuated umbilical cord to the amnios, which is laid open and inverted; a part of the chorion remains attached to the amnios: about an inch above the embryo may be observed the remains of the vitellicle adhering to the outer surface of the amnios.
3629. A morbid ovum, including the chorion and an attached layer of the decidua reflexa; a section has been removed from one side of both these membranes, exposing the cavity of the chorion, to the upper part of which is attached a pyriform bag, two inches in length, consisting of a thin, smooth, semi-transparent membrane; a second and minute flattened cyst is likewise suspended by a fine pellicle from another part of the

internal surface of the chorion; the ramifying villi of the chorion are luxuriantly developed from the whole of its outer surface, and form the bond of union between it and the decidua.

3630. A similar morbid ovum, with the decidua reflexa and a large mass of coagulum attached thcreto; the cavity of the chorion is laid open, exposing a pyriform membranous sac having a similar pedunculate attachment to the inner surface of the chorion.
3631. An embryo, five lines in length, appended by a thick umbilical cord, an inch in length, to the inner surface of the amniotic bag; this has been laid open to expose the embryo; portions of the villous chorion remain attached to the external surface of the amnios.
3632. An embryo, six lines in length, with its amnios, chorion and decidua reflexa, which is thickened and loaded with coagulated blood: the embryo is suspended by a thick umbilical cord, about its own length; part of the abdominal parietes of the embryo have been removed, and a portion of the liver, intestine, and ductus vitello-intestinalis are exposed: a small cyst is appended to the side of the umbilical cord; it has been laid open.
- 3632 A. An embryo, six lines in length, with a portion of the amnios, chorion and decidua reflexa, to the outer surface of which some thick plates of coagulated blood or fibrin are attached: the villous processes which connect the chorion and decidua are shorter than usual; they appear to have been flattened and partially obliterated by pressure: the remains of the vitellicle, which still contains an orange-coloured substance, may be seen between the amnios and chorion, about nine lines distant from the point of reflexion of the amnios upon the umbilicus.

*Presented by William Lawrence, Esq., F.R.S.*

- 3632 B. Two embryos, twins, aborted at the same period, with their respective amniotic sacs, each of which is laid open, and the embryo exposed, attached by its umbilical cord: one of these embryos is double the size of the other; both are in an unnatural condition; the common chorion is attached to a layer of reflex decidua, which is thickened and compacted by coagulated blood. *Presented by William Lawrence, Esq., F.R.S.*

3632 c. An embryo at the same period of development as the preceding, with the ventral parietes of the thorax and abdomen laid open, exposing the heart and liver and the short alimentary canal; the apices of the right and left ventricles are separated by a cleft: the rudimental extremities present in this, as in all the preceding embryos, the form of short, obtuse and divided processes. *Presented by Sir William Blizard, F.R.S.*

3632 D. An embryo, seven lines in length, in which the digital divisions are just beginning to be exhibited on its anterior extremities.

*Presented by William Lawrence, Esq., F.R.S.*

3633. A human embryo, ten lines in length, or at about the eighth week of gestation, with the amnios, chorion, decidua vera and reflexa; the reticulate surface of the decidua vera, which forms the peripheral wall of the perionic cavity, is beautifully shown in this preparation: the amnios and chorion are laid open, showing the embryo suspended by a short and morbidly-enlarged umbilical cord: the loose gelatinous cellular tissue connecting the amnios with the chorion, and the villi connecting the chorion with the decidua, are clearly exhibited.

3634. The trunk of a human embryo, which seems to have attained nearly an inch in length, with the amnios, chorion, decidua reflexa, and a part of the decidua vera: the cavity of the amnios is laid open by a crucial incision; the chorion is connected by a thin layer of firm coagulated matter to the decidua; the line of reflexion, or continuation of the reflex from the true decidua, is distinctly shown in this preparation; the inner surface of the perionic or decidual sac at this line is minutely reticulated; many small orifices may be observed in the decidua vera, which is reflected upwards; the remains of the vitellicle are very clearly displayed by the reflection of a portion of the amnios from the chorion: it is distant an inch from the point of attachment of the umbilical cord, which is morbidly expanded by the development of cysts within its substance; the villous structure of the chorion is almost entirely obliterated in this ovum, probably by the pressure of effused coagulated blood between the chorion and decidua.

3635. Twin embryos, each about fifteen lines in length, included with their am-



niotic sacs in a common chorion; this membrane is attached to the decidua reflexa, which is morbidly laden with coagulated blood: the embryos are exposed in their respective amniotic sacs; the umbilical cord of each is about ten lines in length: the different segments of the arms and legs and the digital divisions of the hand and foot are now established: the palpebral apparatus has commenced by the formation of a groove or fold of the integument at the inner side of the eyeball; the nostrils present the form of two minute apertures a little below the interorbital space, and are not yet supported by a prominent nose; the tongue is very conspicuous, projecting from the interspace of the short maxillæ; the lips are not yet separated from the jaws.

3636. An embryo, fourteen lines in length, attached by an umbilical cord, ten lines in length, to an inverted amnios and chorion, above which is suspended the decidua reflexa: between the amnios and chorion may be seen the vitellicle in the form of a flattened, opaque, oval sac, a line and a half in length; it is an inch distant from the attachment of the cord to the membranes: the structure of the branched villi of the chorion is likewise well displayed in this specimen.
3637. An embryo, one inch and a quarter in length, at between the eighth and ninth week of gestation; it is displaced from the amniotic bag, from which, as well as from the chorion, a section has been removed: the fine albuminous or cellular substance which connects the amnios to the chorion is well displayed in this preparation; the outer surface of the chorion is attached to the morbidly-thickened decidua: the coils of intestine may be discerned through the transparent tunics of the umbilical cord, close to the still uninclosed cavity of the abdomen.
3638. An embryo, at a corresponding period of development, with the amnios, which is laid open by a crucial incision, and a part of the chorion.
- 3638 A. An embryo, at the third month of gestation, with the amnios, chorion, foetal placenta, and a portion of the contiguous decidua; the amnios and chorion are laid open; the external surface of the latter membrane, where it is not attached to the placenta, is now quite smooth.

*Presented by Sir William Blizard, F.R.S.*

- 3638 B. An embryo, at about the fourth month of gestation, with the amnios, chorion, and a large cotyloid placenta, to the margins of which a portion of decidua is attached: the amniotic cavity is torn open, and the foetus displaced and suspended above the membranes.

*Presented by Sir William Blizard, F.R.S.*

3639. A foetus, between the fourth and fifth month of uterine gestation, inclosed in the amniotic sac, together with that part of the chorion which was not attached to the placenta.

- 3639 A. One of twin foetuses, at a corresponding period of uterine gestation, displaced from the amniotic sac, a portion of which, and of the chorion with the placenta, are here preserved; a piece of thread is tied round an opaque spot on the outside of the chorion, to which the membranes of the second foetus were attached.

*Presented by Philip Lugar, Esq., M.R.C.S.*

- 3639 B. The embryo and its membranes, which were aborted with, and subsequently separated from, the preceding preparation; the point of attachment is indicated by the layer of opaque coagulum at the upper part of the sac; the embryo is between seven and eight lines in length; its development corresponds with that which an ordinary embryo would present between the fifth and sixth week of uterine gestation; it hangs from the inner surface of the amnios by a thick umbilical cord about ten lines in length: the vitellicle or umbilical sac presents the appearance of a thin, slightly opaque granular area or surface of an irregular oval form, four lines in the long and three in the short diameter; its outline may be clearly defined when viewed by transmitted light: excepting at this point, the whole amnios is adherent to the chorion; the chorion is remarkably thin; small portions of it may, however, be seen in different places reflected from the amnios: the characteristic branched villi or filamentary processes are developed, but in unusually small numbers, from different parts of the external surface of the chorion.

*Presented by Philip Lugar, Esq., M.R.C.S.*

- 3639 c. The ovaria, oviducts and impregnated uterus, with the embryo, its placenta and membranes, at between the third and fourth month of uterine

gestation: the uterus is laid open, as also the chorion and amnios, exposing the foetus *in situ*: the circular cicatrix of the prominent corpus luteum may be observed in the right ovarium.

*Presented by Dr. Batty, F.L.S.*

3640. A section of the uterus and placenta at about the sixth month of gestation: the umbilical cord is preserved with this preparation.

3640 A. A section of the uterus and placenta at the sixth month of gestation: the uterus has been dissected from the outside, and the course of the uterine veins thus traced as they progressively descend through the different strata of muscular fibres to the inner surface of the uterus: the crescentic apertures and valvular folds by which they communicate with each other are shown; and the relation of this structure to insure the closing of the sinuses by the contraction of the surrounding muscular fibres may be readily appreciated: a bristle is placed across one of the uterine veins at the point where it communicates with two deeper-seated veins.

*Presented by Mr. Owen.*

3641. A circular section of the placenta and adherent foetal membranes, to show the lobulated structure of the uterine surface.

3642. A longitudinal section of a gravid uterus of the seventh month, with a corresponding portion of the placenta, decidua, foetal membranes, and part of the umbilical cord; the cut margin of the amnios is reflected for some distance from the chorion, and this again from the decidua, of which two layers, probably corresponding with the uterine and ovuline decidua of the embryonic periods, are very clearly shown: some red injection has been thrown into the uterine arteries, and yellow injection into the uterine veins; both injections have passed into the substance of the placenta, principally near the interspaces of its lobules\*.

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\* Hunter's Description of the Human Placenta, which is illustrated by this and subsequent preparations, is as follows:

"The necessary connexion subsisting in all animals between the mother and foetus, for the nourishment of the latter, as far as I know, takes place in two ways. In some it is continued, and subsists through the whole term of gestation; in others the union is soon dissolved; but an apparatus is provided, which at once furnishes what is sufficient for the support of the animal till it comes forth.



3643. The ovaria, oviducts and gravid uterus, with its contents, at the seventh month of gestation: the uterine vessels have been minutely injected;

“The first of these are the viviparous, the second the oviparous animals, both of which admit of great variety in the mode by which the same effect is produced<sup>1</sup>. In the first division is included the human species, which alone will engage our present attention. But before I describe this connexion, it may be necessary that the reader should understand my idea of generation; I shall therefore refer him to what I have said upon that subject in my account of the free martin<sup>2</sup>.

“In the human species, the anatomical structure of the mother and embryo, relative to foetation, being well known, it will only be necessary fully to describe the nature of the connexion between them, which is formed by the intermediate substance, called placenta. For this purpose we must first consider the placenta as a common part; next, the uterus as belonging to the mother, yet having an immediate connexion with the placenta, from which the nourishment of the foetus is to be derived; which will lead us lastly to a consideration of those peculiarities of structure, by means of which the foetus is to receive its nourishment, and which likewise constitutes its immediate communication with the placenta. It is the structure of this intermediate substance, and its connexion with the child and the uterus of the mother, which have hitherto been so little understood; and without an accurate knowledge of which, it was impossible any just idea could be formed of its functions.

“The placenta is a mass lying nearly in contact with the uterus; indeed, it may in some degree be said to be in continuity with a part of its internal surface. On the side applied to the uterus the placenta is lobulated, having deep irregular fissures. It is probable, from this structure of the placenta, that the uterus has an intestine motion while in the time of uterine gestation; not an expulsive one, which those lobes of the placenta allows of; but all these lobes are united into one uniform surface on that surface next to the child, where its umbilical vessels ramify. When we cut into the placenta, its whole substance appears to be little else than a net-work, or spongy mass, through which the blood-vessels of the foetus ramify, and indeed seems to be principally formed by the ramifications of those vessels; it exhibits hardly any appearance of connecting membrane; but we cannot readily suppose it to be without such a membrane, as there is so much regularity in its texture. The cells or interstices of each lobe communicate with one another, even much more freely than those of the cellular membrane in any other part of the body; so that whatever fluid will pass in at one part readily diffuses itself through the whole mass of lobe; and all the cells of each lobe have a communication at the common base.

“This structure of the placenta, and its reciprocal communication with the two bodies with which it is immediately connected, form the union between the mother and foetus for the support of the latter. Prior to the time I have mentioned above, anatomists seem to have been wholly unacquainted with the true structure of placenta. By notes taken from Dr. Hunter’s lectures, in the winter 1755–6,

<sup>1</sup> “It may be remarked here, that the oviparous admit of being distinguished into two classes, one where the egg is hatched in the belly, as in the viper, which has been commonly called viviparous; the others, where the eggs have been first laid and then hatched, which is the class commonly called oviparous, such as all the bird tribe, and many others, as snakes, lizards, &c.”

<sup>2</sup> *Vide Philosophical Transactions*, vol. lxi. (1779), p. 279.

the right ovarium is bisected through the corpus luteum, which is situated near the margin of the ovarium ; the original cavity of the vacated

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it appears that he expressed himself in the following manner<sup>1</sup>: 'The substance of the placenta is a fleshy mass, which seems to be formed entirely of the vessels of the umbilical rope.' In another part, mentioning the appearances when injected, he says, 'and upon a slight putrefaction coming on, you will find the whole appearing like a mass of vessels:' then says, 'there is always a white uninjected substance between the vessels ; but whether lymphatics or what, I cannot tell.' This uninjected substance, mentioned by Dr. Hunter, is what forms the cellular structure.

"The placenta seems to be principally composed of the ramifications of the vessels of the embryo, and may have been originally formed in consequence of those next to the uterus laying hold, by a species of animal attraction, of the coagulable lymph which lines the uterus. It might take place in a manner resembling what happens when the root of a plant spreads on the surface of moist bodies ; with this difference, that in the present instance the vessels form the substance through which they ramify, as in the case of granulations.

"At the time, or perhaps before the female seed enters the uterus, coagulable lymph, from the blood of the mother, is thrown out everywhere on its inner surface, either from the stimulus of impregnation taking place in the ovarium, or in consequence of the seed being expelled from it. But I think the first the most probable supposition ; for we find in extra-uterine cases, that the decidua is formed in the uterus, although the ovum never enters it ; which is a proof that it is produced by the stimulus of impregnation in the ovarium, and that it is prior to the entrance of the ovum into the uterus. When it has entered the uterus, it attaches itself to that coagulable lymph, by which, being covered and immediately surrounded<sup>2</sup>, there is formed a soft pulpy membrane, the decidua, which, I believe, is peculiar to the human species, and to monkeys, I never having found it in any other animal. That part which covers the seed or fœtus, where it is not immediately attached to the uterus, and likewise forms a membrane, was discovered by Dr. Hunter, and is by him called decidua reflexa<sup>3</sup>. The whole of this coagulable lymph continues to be a living part for the time ; the vessels of the uterus ramify upon it ; and where the vessels of the fœtus form the placenta, there the vessels of the uterus, after passing through the decidua, open into the cellular substance of the placenta, as before described. As this membrane lines the uterus and covers the seed, it is stretched out, and be-

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<sup>1</sup> "These quotations were taken from Mr. Galhie's MS. of Dr. Hunter's lectures, who is one of the gentlemen that favoured Dr. Hunter, upon a former occasion, with the use of his notes. *Vide* Dr. Hunter's Commentaries."

<sup>2</sup> "This is somewhat similar to another operation in the animal œconomy. If an extraneous living part is introduced into any cavity, it will be immediately inclosed with coagulable lymph. Thus we find worms inclosed, and hydatids, that have been detached, afterwards inclosed ; but in those cases this is a consequence of the pressure of the extraneous body, whereas in the uterus it is preparatory."

<sup>3</sup> "The placenta is certainly a fœtal part, and is formed on the inside of the spongy chorion, or decidua. How far the decidua reflexa is a uterine part, I do not yet know ; if it is, then the ovum must be placed in a doubling of the coagulum, which forms the decidua ; but if the ovum is attached to the inside of the decidua, then the decidua reflexa is belonging to the fœtus."



ovisac is reduced to a mere fissure by the centripetal growth of the thickened, vascular, and parenchymatoid proper tunic of the ovisac; the

comes thinner and thinner, as the uterus is distended by the fœtus growing larger, especially that part of it, called decidua reflexa, which covers the fœtus; as there it cannot possibly acquire any new matter, except we could suppose that the fœtus assisted in the formation of it. This membrane is most distinct where it covers the chorion; for where it covers the placenta it is blended with coagula in the great veins that pass obliquely through it, more especially all round the edge, where innumerable large veins come out; but the chorion and decidua can be easily distinguished from one another, the decidua being less elastic.

“From the description now given, I think we are justified in supposing the placenta to be formed entirely by the fœtus, which is further confirmed by extra-uterine cases, and by the formation of the membrane in the egg, there being no living organic part to furnish them, and the decidua we must suppose to be a production of the mother; of both which, the circumstance of the decidua passing between the placenta and uterus, may be considered as an additional proof. For if the vessels of the fœtus branched into a part of the decidua, we might conceive the whole placenta to be formed from that exudation; the portion of it where the vessels had ramified, like the roots of a plant, becoming thicker than the rest, and forming the placenta. If that were the case, this membrana decidua, when traced from the parts distinct, and at a distance from the placenta, should be plainly seen passing into its substance all round at the edges, as a continuation of it. But the fact is quite otherwise; for the decidua can be distinctly traced between the placenta and uterus, hardly ever passing between the lobuli: the vessels of the fœtus never entering into it, and of course none of them ever coming in absolute contact with the uterus. But what may be considered as still a stronger proof that the decidua is furnished by the uterus, is, that in cases of extra-uterine conception, where the fœtus is wholly in the ovarium or Fallopian tube, we find the uterus lined with the decidua, having taken on the uterine action; but no placenta, that being formed by the fœtus, and therefore in the part which contained it.

“The vessels of the fœtus adhering, by the intervention of the decidua, to a certain portion of the uterus when both are yet small, as the uterus increases in every part of its surface during the time of uterine gestation, we must suppose that this surface of adhesion increases also; and that by the elongation of those vessels of the fœtus in every direction, this substance should likewise be increased in every direction: this is in some degree the case, yet the placenta does not occupy so much of the enlarged surface of the uterus as one at first would expect.

“The vessels of the uterus in the time of the gestation, are increased in size nearly in a proportion equal to the increased circumference of the uterus, and consequently in a proportion much greater than the real increase of its substance. But when we reflect that the uterus ought not to be considered as hollow, but as a body nearly solid, on account of its contents, which derive support from this source, and that a much greater quantity of blood must necessarily pass than what is required for the support of the viscus itself, we cannot be at a loss to account for the greatly increased size of its vessels.

“The arteries which are not immediately employed in conveying nourishment to the uterus, go on towards the placenta, and proceeding obliquely between it and the uterus, pass through the decidua



anterior parietes of the uterus have been removed, exposing a portion of the decidua reflected from the chorion, which itself is reflected, near the cervix uteri, from the unopened amnios. On the opposite side of the uterus a section of the parietes is reflected from the decidua and from a portion of the placenta, showing on its inner surface the large orifices of the uterine veins, and the corresponding orifices in the decidua adhering to the uterine surface of the placenta, some of which are indicated by

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without ramifying; just before they enter the placenta, after making two or three close spiral turns upon themselves, they open at once into its spongy substance without any diminution of size, and without passing beyond the surface, as above described. The intention of these spiral turns would appear to be that of diminishing the force of the circulation in the vessels as they approach the spongy substance of the placenta, and is a mechanism calculated to lessen the quick motion of the blood in a part where a quick motion was not required. These curling arteries at this termination are in general about half the size of a crow's quill, and sometimes larger.

“The veins of the uterus appropriated to bring back the blood from the placenta, commence from this spongy substance by such wide beginnings, as are more than equal to the size of the veins themselves. These veins pass obliquely through the decidua to the uterus, enter its substance obliquely, and immediately communicate with the proper veins of the uterus. The area of these veins bears no proportion to their circumference, the veins being very much flattened.

“This structure of parts points out at once the nature of the blood's motion in the placenta; but as this is a fact but lately ascertained, a just idea may perhaps be conveyed by saying, that it is similar, as far as we yet know, to the blood's motion through the cavernous substance of the penis.

“The blood, detached from the common circulation of the mother, moves through the placenta of the foetus, and is then returned back into the course of the circulation of the mother, to pass on to the heart.

“This structure of the placenta, and its communication with the uterus, leads us a step further in our knowledge of the connexion between the mother and foetus: the blood of the mother must pass freely into the substance of the placenta, and the placenta most probably will be constantly filled, the turgidity of which will assist to squeeze the blood into the mouths of the veins of the uterus, that it may again pass into the common circulation of the mother; and as the interstices of the placenta are of much greater extent than the arteries which convey the blood, the motion of the blood in that part must be so much diminished as almost to approach to stagnation; so far and no further does the mother appear to be concerned in this connexion.

“The foetus has a communication with the placenta of another kind. The arteries from the foetus pass out to a considerable length, under the name of the umbilical arteries, and when they arrive at the placenta, ramify upon its surface, sending into its substance branches which pass through it, and divide into smaller and smaller, till at last they terminate in veins; these uniting, become larger and larger, and end in one, which at last communicates with the proper circulation of the foetus.

“This course of vessels, and the blood's motion in them, is similar to the course of the vessels and the motion of the blood in other parts of the body.”—*Animal Economy*, 2nd ed. 4to, p. 166.

portions of bristle inserted into them: several of the ruptured extremities of the minute tortuous uterine arteries which were passing into the placenta may likewise be discerned. The uterine veins in the layers of the decidua, near the margin of the placenta, are laid open and traced to the cellular surface of the placenta.

3644. The ovaria, oviducts and gravid uterus, with its contents, at the eighth month of gestation: the left ovary is bisected, and a section has been removed from the right ovary, in which the corpus luteum, or altered ovisac that contained the germ of the present fœtus, is situated. The place of exit of the impregnated ovum is indicated by a vascular spot or cicatrix; part of the original cavity of the ovisac is still unobliterated; it is lined by a membrane or layer of substance much less vascular than the altered thickened tunic of the ovisac which forms the proper corpus luteum. The posterior parietes of the uterus have been removed, together with the corresponding decidua and chorion, to expose the fœtus in its natural position in the amnios, from which also a portion has been dissected away: the uterine arteries are injected, and the vascularity of the decidua is very clearly demonstrated in the portions which are shown near the cut margins of the uterus.
3645. A section of a gravid uterus, at the ninth month of gestation, with a portion of the placenta and fœtal membranes attached: the uterine veins are filled with dark-coloured injection, and their valvular mode of intercommunication, as they pass between the thin layers of muscular fibres to the inner surface of the uterus, is well displayed on the cut surface of this preparation. The terminal orifices of the uterine veins which communicate with the cells of the materno-placental tissue include a reticulate structure, of which the meshes are formed by the orifices of the materno-placental cells; the uninjected villi of the fœtal placenta may be seen projecting from these orifices into the uterine sinuses. The margins of the terminal orifices of the uterine veins are smooth, even and natural; the injection has passed through them into the reticulate commencement of the venous cells of the maternal placenta, the whole of which have thus been filled with the injection. The amnios, chorion and internal layer

of decidua are well displayed on the foetal portion of placenta here preserved.

3646. A smaller section of the same uterus and placenta, similarly injected: the reticulate structure of that part of the parietes of the terminal uterine veins which is in contact with the surface of the placenta, and receives the blood from the cells of the maternal portion, may be here distinctly seen in a section of a vein close to the margin of the placenta; the vein in question may be traced passing through the decidua which connects the placenta with the uterus.
3647. A section of a placenta, showing on its uterine surface several of the contorted uterine arteries which convey the maternal blood into its substance: the venous cells of the maternal placenta are likewise filled in many parts with a dark injection from the uterus: a red injection has been thrown into the foetal arteries, and a white injection into the foetal veins; but the capillaries and the delicately ramified villi which constitute the foetal portion of the placenta remain for the most part uninjected; a few of them have received the white injection from the vein.
3648. A section of the placenta, of which the uterine arteries have been filled with red injection, and the veins, less successfully, with some dark-coloured injection: a few of the contorted terminations of the uterine arteries may be observed on the uterine surface of the placenta; one of the interlobular fissures has been widened, and the continuation of a uterine vein is shown passing down towards the foetal surface.
3649. A section of a twin placenta, with a portion of the chorion and amnios.
3650. A section of the placenta, of which the foetal arteries have been filled with black injection and the veins with white; the injection has not passed into the capillaries of the placental villi.
3651. A section of a placenta, with the placental extremity of the umbilical cord: yellow injection has been thrown into the umbilical arteries, and red injection into some of the branches of the foetal veins, which has passed into the capillaries of the corresponding part of the placenta.
3652. An adjoining section of the same placenta.



3653. A third section of the same placenta.
3654. A longitudinal section of the same placenta, with a portion of the chorion and decidua continued from its circumference.
3655. A small section of a placenta which has been filled with red injection by the foetal vessels : corresponding portions of the amnios, chorion, and decidua are preserved.
3656. A similar preparation.
3657. A section of a placenta, injected by the foetal vessels, with the branched villous processes composing the foetal portions unravelled by maceration.
3658. The umbilical cord and foetal placenta, with its structure similarly displayed ; it is of unusually large size.
- 3658 A. The placentæ, umbilical cords and membranes of twins : both placentæ are minutely injected by the foetal vessels. *Prepared by Mr. Clift.*
3659. A portion of the organized fibrin and chorion which surrounded an extra-uterine abdominal foetus\*.

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\* With respect to extra-uterine foetation, Mr. Hunter has published the following remarks :

“ In addition to what I have said about the connexion between the mother and child, in natural cases, it is necessary to observe, that though the uterus is appropriated for the support of the foetus, as best fitted for that purpose, yet it is not essential to its growth, as any other part in which the child may be situated is capable of receiving the same provisional stimulus for supplying it with nourishment as the uterus ; and this, I believe, is peculiar to generation. This prompts me to make the following observations upon the different situations of the foetus in extra-uterine cases which are extraordinary, happen seldom, and when they do occur, are often attended with so many hindrances to critical investigation, as hardly to allow of thorough or satisfactory information.

“ Such cases are readily distinguished from natural ones, by the uterus being found entire and empty ; and they may be divided into three different kinds, according to the situation of the foetus in the ovary, Fallopian tube, or in the cavity of the abdomen.

“ From a want of the appearances which usually attend the natural process, the investigation of extra-uterine cases is attended with considerable difficulty ; for where uncommon actions have taken place, as well as in cases of disease, the natural texture of the parts is very much altered, and appears to be lost ; not only by the parts themselves being enlarged, but from having a great deal of new matter superadded to them, by which they lose their natural distinctness, and become less fitted for examination than those which only have a relation to them, and which preserve their natural actions peculiar to that state.

“ From these difficulties, and a want of accuracy in those who made the examination, it is not at present clear, with respect to many of the extra-uterine cases upon record, whether they were ovarian

- 3660. A male fœtus, at about the second month of gestation: the tail-like prominence of the os coccygis is still conspicuous at this period; the commissure of the eyelids is closed by a continuation of the cuticle.
- 3661. A female fœtus, at about the second month of gestation; the clitoris, at this period, is remarkable for its large size.
- 3662. A male fœtus, a little further advanced; some coils of intestine protrude through the umbilical aperture of the abdomen.
- 3663. A female fœtus, between the second and third months of gestation.
- 3664. A female fœtus, at the third month of gestation.
- 3665. A female fœtus, a little further advanced.
- 3666. A female fœtus, at the fourth month of gestation.
- 3667. A male fœtus, at about the fourth month of gestation.
- 3668. A male Negro fœtus, at the same period of gestation: the dark pigment, and the characters of the expanded alæ of the nose and the thickened lips, already begin to be manifested.

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cases, Fallopian tube cases, or abdominal cases; when, if they had been acquainted with the principle in which they differ, nothing could have been more easy than to distinguish them. It is not difficult, perhaps, at the very first view, to distinguish an abdominal case from either of the two first; for if the ovaria and Fallopian tube are entire, natural, and can be well distinguished to be as those parts are when the circumstances are natural, then we may be sure it is an abdominal case. Appearances, however, may not in all cases be distinct; but the parts may adhere, or be otherwise rendered so obscure, that an abdominal case might be confounded with either of the two first; therefore it is essential to have a characteristic difference established between the two first and the third.

“The invariable difference between the two first, and the abdominal cases, will be in the vessels by which the child is nourished; for the arteries and veins belonging to the part in which the child is contained must be enlarged; which, being the increase of a natural part, will be readily ascertained, and the nature of the case as readily determined. We may lay it down as a principle, that when the spermatic artery, and veins of either side, is enlarged in an extra-uterine case, that the fœtus is in the ovarium or Fallopian tube, since there are no other blood-vessels which supply these parts; and if any other system of vessels, as the mesenteric, are increased in size, while the spermatic are in a natural state, we may, with equal certainty, conclude the fœtus to be contained in the general cavity of the belly. As this becomes the great criterion, and as the situation and time will not always allow very nice investigation on the spot, where the person employed has an opportunity of taking away the parts concerned, I would advise his taking along with them the aorta and vena cava, cut through above the origins of the spermatic vessels.”—*Animal Economy*, 2nd ed. 4to, p. 173.

3669. A male foetus, at between the fourth and fifth months of gestation.
3670. A male foetus, at between the fourth and fifth months of gestation.
3671. A female foetus, at the fifth month of gestation.
3672. A male foetus, at about the fifth month of gestation.
3673. A female foetus, between the fifth and sixth months of gestation.
3674. A male Chinese foetus, between the fifth and sixth months of gestation.  
The comparatively large size of the hands of this foetus, as compared with those of the preceding and following foetuses, which are female, may be noticed.
3675. A female foetus, at about the sixth month of gestation.
3676. A male foetus, at the sixth month of gestation.
3677. A female foetus, between the sixth and seventh months of gestation.
3678. A female foetus, at about the eighth month of gestation ; the clitoris is now concealed by the labia minora.
3679. A female foetus, between the eighth and ninth months of gestation.
3680. A female foetus, at the termination of gestation.
- 3680 A. A female foetus, of unusually large size, and exhibiting precocious development of the external pudenda and the hair of the head : this was the ninth child of a gardener's wife at Twickenham, and was still-born : the mother recovered. *Presented by Sir Everard Home, Bart.*
- 3680 B. The internal organs of generation of the same foetus, preserved to show their unusually large size : the ovaria present the slender elongated form and smooth surface characteristic of their foetal state.  
*Presented by Sir Everard Home, Bart.*
3681. Five foetuses, the produce of the same gestation, and successively brought forth at the same period of parturition : three were still-born ; two of these may be distinguished by their shrivelled and distorted aspect : two were born alive, and survived their birth but a short time. The closed eyelids, the shape of the ears and the external organs of generation, together with the size of each foetus, correspond with the state of development usually exhibited at about the fifth month of uterine gestation. A label is attached



to the right hand of each foetus, indicating the order of its birth. Such particulars as have been recorded respecting this remarkable case of human multiparous gestation, are given in the subjoined account\*.

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\* "A remarkable case of numerous Births, with Observations. By MAXWELL GARTHSHORE, M.D., F.R.S. and A.S. In a letter to Sir Joseph Banks, Bart., P.R.S. Read June 21, 1787. [Phil. Trans. vol. lxxvii. p. 344.]

"To Sir Joseph Banks, Bart., P.R.S.

"St. Martin's Lane, May 28, 1787.

"SIR,—The following very extraordinary case, communicated to me by Dr. Blane, F.R.S., I take the liberty, at his desire, to transmit to you, with his letter to me containing the proofs of its authenticity; hoping that it will appear to you, as it did to us, worthy of being read at one of the Meetings of the Royal Society, as a fact in natural history which is equally uncommon, curious, and well-vouched. In order, however, to make its singularity more apparent, I have taken the liberty to subjoin some observations on births of this kind, with such well-authenticated accounts of similar events as I have been able to procure, confining myself chiefly to those which have happened in our own country, where we are least likely to be deceived.

"I have the honour to be, &c.,

"MAXWELL GARTHSHORE.

"P.S. As one proof of its singularity, I, many months ago, employed various friends at St. Petersburg, Berlin, Vienna, Lyons, Paris and Ghent, to collect for me well-authenticated cases of this kind, and I have not as yet been able to procure any."

"Copy of a letter from Dr. BLANE, Physician to His Majesty's Navy and to St. Thomas's Hospital, F.R.S., to Dr. Garthshore, Physician to the British Lying-in Hospital.

"Sackville-street, June 22, 1786.

"DEAR SIR,—A few days ago, I received from the country an account of a woman who was delivered of five children at a birth in April last. As your extensive experience and reading in this line of practice enable you to judge how far this fact is rare or interesting, I submit it to you, whether it deserves to be communicated to the Royal Society. Mr. Hull, the gentleman who sent me the case, is a very sensible and ingenious practitioner of physic, at Blackburn, in Lancashire. He attended the labour himself from beginning to end, and his character for fidelity and accuracy is well known to me, as he was formerly a pupil at the hospital to which I am physician; so that no fact can be better authenticated. He mentions also, that he has preserved all those five children in spirits; and, if desired, he will send them for the inspection of the Society<sup>1</sup>.

"I am, with great regard, &c.,

"GILBERT BLANE.

"Margaret Waddington, aged twenty-one, a poor woman of the township of Lower Darwin, near

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<sup>1</sup> "They were accordingly sent; and having been exhibited to the Society when this paper was read, are now deposited in the Museum of Mr. John Hunter."

## SERIES XVI. Corpora lutea.

[Ovisacs obliterated or modified after the escape of an impregnated ovum.]

3682. The right ovarium, oviduct, and corresponding extremity of the uterus of an Ewe (*Ovis Aries*, LINN.), which had been killed, probably, two or

Blackburn, in Lancashire, formerly delivered of one child at the full term of pregnancy, conceived a second time about the beginning of December 1785, and from that period became affected with the usual symptoms that attend breeding. At the end of the first month she became lame, complained of considerable pains in her loins, and the enlargement of her body was so remarkably rapid, that she was then judged by her neighbours to be almost half-gone with child. At the end of the second month she found herself somewhat larger, and her breeding complaints continued to increase. When the third month was completed, she thought herself fully as large as she had formerly been in her ninth month, and to her former symptoms of nausea, vomiting, lameness, and pain of the loins, she had now added a distressing shortness of breath. She continued to increase so rapidly in size, that she thought she could perceive herself growing larger every day, and she was under the frequent necessity of widening her clothes. When she reckoned herself eighteen weeks gone, she first perceived somewhat indistinctly the motion of a child.

“‘ By the 20th of April, 1786, all her complaints were become much more distressing; she had much tension and pain over all the abdomen, her vomiting was incessant, and she now could not make water but with the utmost difficulty.

“‘ The symptoms being palliated by Mr. Lancaster, she advanced in her pregnancy to Monday the 24th, when, being supposed to have arrived at the twentieth week, she was seized with labour pains. These continued gradually to increase till the next day, about two in the afternoon, at which time I was sent for, Mr. Lancaster being absent, and she was soon delivered of a small, dead, but not putrid female child. The pains continuing, this was soon followed by a second less child; to this very soon succeeded a third, larger than the first, which was alive; to these a fourth soon followed, somewhat larger than the first, and very putrid; last of all, there soon succeeded a fifth child, larger than any of the former, and born alive.

“‘ These five children were all females; two were born alive; and the whole operation was performed in the space of fifty minutes. The first made its appearance at two in the afternoon, and the last at ten minutes before three. Each child presented naturally, was preceded by a separate burst of water, and was delivered by the natural pains only. In a short time after the birth of the last, the placenta was expelled by nature, without any hæmorrhage, was uncommonly large, and in some places beginning to be putrid. It consisted of one uniform continued cake, and was not divided into distinct placentulæ, the lobulated appearance being nearly equal all over. Each funis was contained in a separate cell, within which each child had been lodged; and it was easy to perceive, by the state of the funis, and that part of the placenta to which it adhered, in which sac the dead, and in which the living children had been contained. I examined the septa of the cells very carefully, but could not

three days after the coitus. Two, vacated ovisacs are shown in the ovarium; the orifice in each, from which the ovum has escaped, is surrounded

divide them as usual into distinct laminæ, nor determine which was chorion and which amnios. I could not prevail on the good women to allow me to carry it home, to be more narrowly inspected; and I submitted more readily to their prejudice for its being burned, as its very soft texture seemed to me to render it hardly capable to bear injection.

“ ‘ The two living children having survived their birth but a short time, I was allowed to carry them home; and I have preserved the whole five in spirits, and have since weighed and measured them, and find their proportions to be as follows, in Avoirdupois weight, inches, and parts :—

	oz.	drs.	Length.
“ ‘ The first, born dead . . .	6	12	. . . 9 inches.
“ ‘ The second, born putrid . . .	4	6	. . . $8\frac{1}{4}$
“ ‘ The third, born alive . . .	8	12	. . . $9\frac{1}{8}$
“ ‘ The fourth, born putrid . . .	6	12	. . . $9\frac{1}{8}$
“ ‘ The fifth, born alive . . .	9	0	. . . $9\frac{1}{8}$

“ ‘ The mother, in spite of the crowds with which her chamber was continually filled, continued to recover, and was able to be out of bed on the 27th and 28th, her third and fourth days; but finding herself then weak, by my advice kept her bed till the 11th of May, when she went out of doors, and on the 21st walked to Blackburn, two miles distant. This was the 27th day from her delivery, she having entirely recovered her strength without any accident. It may not be improper to add, that the husband of this woman has been in an infirm state of health for three years past, and is now labouring under a confirmed phthisis.

“ ‘ I am, Sir, &c.,

(Signed) “ ‘ JOHN HULL.’

“ ‘ Blackburn, Lancashire, June 9, 1786.’

“ *Observations on numerous Births.*

“ ‘ Though the females of the human species produce most commonly but one child at a birth, and though their formation with only two breasts, and one nipple to each, renders it probable they were not originally intended to produce in general more than two, yet from what we know of the womb and its appendages, and what from the latest experiments we are led to conjecture as to the mode of conception, we cannot presume *à priori* to set limits to the fertility of nature, nor determine decisively what number of fœtuses may be conceived and nourished to a certain period in the human uterus at the same time.

“ ‘ The present singular and well-attested case assures us that five have certainly been born at once, and we have no title absolutely to reject all the testimonies of even more numerous births, or to say that in some rare instances this number has never been exceeded.

“ ‘ What has tended to render relations of this sort ridiculous, and to throw a degree of discredit on the whole, is the many marvellous and evidently absurd and incredible histories which not only the retailers of prodigies, but even the credulous writers of medical observations have collected.

“ ‘ I need only to refer, to those who wish to amuse themselves with surprising relations of this kind, to the curious collections of Schenkus, Schurigius, Ambrose Parè and others.



with a circular lip formed by the tumid and everted vascular 'tunica propria'\* of the ovisac; a section is removed from the side of each ovisac

"But in order to show how very uncommon births of this kind are, and how truly singular the case communicated by Mr. Hull to Mr. Blane is, I take the liberty to subjoin a short view of the usual course of nature in this matter among our own countrywomen, where we are least likely to be deceived.

"Though female fertility certainly varies according to the climate, situation, and manner of life, yet I believe it may be taken for a general rule, that where people live in the most simple and natural state, if they are the best nourished, and if they enjoy the firmest health and strength, they will there be the most fertile in healthy children; but we have no data to determine that they will there have the greatest number at one birth.

"At the British Lying-in Hospital, where we have had 18,300 delivered, the proportion of twins born has been only one in ninety-one births. In the Westminster Dispensary, of 1897 women delivered, the proportion of twins has been once in eighty births; but in the Dublin Lying-in Hospital, where above 21,000 have been delivered, they have had twins born once every sixty-second time. The average of which is once in seventy-eight births nearly in these kingdoms.

"The calculations made in Germany from great numbers, in various situations, state twins as happening in a varied proportion from once every sixty-fifth to once every seventieth time.

"But in a more accurate and later calculation made at Paris by M. Tenon, Surgeon to the Salpêtrière, we learn that in 104,591 births the proportion of twins was only one in ninety-six, which is only a small degree less than we have calculated at the British Lying-in Hospital.

"It would be easy to add other calculations, all differing from these and from one another, more or less; but I hope these are sufficient to show that nature observes no certain rule in this matter, and that even twins, the most usual variation, is not a very common occurrence.

"When we advance to triplets, or three born at once, we find comparatively very few instances in this or any other country; and although every one has heard of such events as now and then happening, yet very few have seen them.

"In all those 18,300 women delivered at the British Lying-in Hospital, there has not been one such case. In the London Lying-in Hospital, where, being instituted later, much fewer have been delivered, they have had two such recorded as prodigies. In the Westminster Dispensary, in 1897 women delivered, there has been but one such event.

"In the Dublin Hospital, in 21,000 births, they have had triplets born thrice, or once in 7000 times, but have never exceeded that proportion or number born at one time.

"In a pretty extensive practice of above thirty years, both in the county of Rutland and in London, I have attended but one labour where three children were born; am personally acquainted with but one lady who, at Dumfries in Scotland, after bearing twins twice, was delivered of three children at once; and I was never acquainted with any one who produced a greater number.

\* 'External tunic' or 'external membrane of the Graafian vesicle' of those authors who regard the ovarian vesicle ('ovisac' of Dr. Barry) as the 'internal tunic' of the Graafian vesicle.

exposing its cavity, into which a portion of a small quill is introduced; the parts have been minutely injected; and the great vascularity of the

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“Yet so much does this matter vary at Edinburgh, that Dr. Hamilton, Professor of Midwifery, writes, he has seen triplets born there five or six times in less than twenty-five years.

“Mauriceau, in a long life of very extensive practice at Paris, with opportunities of knowing most things extraordinary that happened in his time in France, tells us that he had seen triplets born but a few times; had heard of four in that city but once, and mentions no greater number.

“One circumstance which he relates is so far worthy of attention, as it accords with one somewhat similar subjoined to Mr. Hull’s case now read, viz. ‘that the husband of one of those women who bore three children was by trade a painter, and had been, for two years preceding this birth, paralytic over one-half of his body, and yet had no reason to doubt the fidelity of his wife.’

“These facts, as far as they are to be depended on, may show us that the capacity of procreation in the male may remain under very infirm health, and that we ought to judge with candour of such wives as are fruitful when living with very ailing husbands, and who produce healthy children in the eighth or even ninth month after their death, as we can never say determinately under what degree of disease the male is totally incapable of procreation; more especially as we are very certain that the female is not, when labouring under very desperate and certainly fatal diseases, provided the principal organs of generation be sound. Nay, in cases of pulmonary phthisis, the life of the female seems to be protracted by pregnancy; and I have attended a lady, who, after being pronounced irrecoverably hectic, lived long enough to be twice delivered naturally of healthy children at the full time.

“But what particular circumstances of constitution, or state of health, can capacitate the male to become the father of more than one child at a birth, or how this could be effected should it be wished, remains among those secrets of nature which our want of facts and observations renders us utterly incapable to speculate upon.

“It seems probable, and these two observations, as well as Spallanzani’s and other late experiments would rather incline us to suppose, that these numerous births do depend most on the structure and state of the female organs; but nothing that I know of has ever been discovered in this obscure matter.

“The occurrence of four born at once we find to be much more uncommon; and I think Haller’s conjecture rather than calculation of its happening once in 20,000 births very much underrated, as it appears that once in 100,000 would be much nearer the truth. Of this, however, we have several well-authenticated cases which have happened in this island. In the year 1674 there was published in London a quarto pamphlet, intitled ‘The Fruitful Wonder, or a strange relation from Kingston-upon-Thames, of a woman who upon Thursday and Friday, the Fifth and Sixth days of this Instant, March 1673–4, was delivered of Four Children at one Birth, viz. three Sons and one Daughter, all born alive, lusty Children, and perfect in every Part, which lived Twenty-four Hours, and then died, all much about the same Time; with several other Examples of numerous Births from credible Historians, with the Physical and Astrological Reasons for the same. By J. P., Student in Physic.’

“Dr. Plott, in his History of Staffordshire, p. 194, mentions Eleanor, the wife of Henry Diven of Watlington, who was delivered of four children at a birth in the year 1675.

“Sir Robert Sibbald, in his *Scotia Illustrata*, after mentioning a case of three born at once, adds,

proper membrane of the ovisac, the thickened folds of which are encroaching upon its cavity, is well demonstrated: a bristle is inserted into the abdominal aperture of the oviduct.

‘Imo in variis regni locis repertæ sunt mulieres quæ quatuor fœtus uno partu ediderunt,’ but makes no mention of more.

“ In the Gentleman’s Magazine, which is reckoned a pretty authentic record of the times, we have the following accounts of numerous births :—

“ Ann Boynton of Hensbridge, in Somersetshire, was this day, June 1, 1736, delivered of three daughters and one son; one of the daughters died, the rest are likely to live. The mother has been married but four years, and has had twice twins before, which completes the number of eight children at three births.

“ October 3, 1743, at Rate, in Berkshire, Joan Galloway was delivered of two boys and two girls, three of whom were alive.

“ In January, 1746, the wife of Plumer, a labouring man, at Mill-Wimley, near Hitchin, Hertfordshire, was delivered of three living boys and one dead.

“ August 22, 1746, the wife of Williams, of Coventry-street, Piccadilly, was delivered of two boys and two girls, all likely to live.

“ June, 1752. A woman in the parish of Tillicultrie, near Stirling in Scotland, was delivered of four children, which were all immediately baptized, and all died at the same time the next morning.

“ In September, 1757, a poor woman of Burton-Ferry, Glamorganshire, was delivered of three boys and a girl.

“ Dr. Hamilton, before-mentioned, writes, that not many years ago a woman was delivered of four children at Pennycuick, the seat of Sir John Clark, Bart., near Edinburgh, when she was advanced to the middle of her last month of pregnancy, and that some of these children lived two or three years. He further says, that five years ago he attended a woman at Edinburgh, who in the seventh month of her pregnancy, after a journey of thirty miles, was suddenly delivered of four children, all perfect and well-grown for the time, of which, one was born dead, and three alive; but those three died next day. He further adds, that these are the only cases of quadruplets, or any larger number, he had ever heard of, as born in Scotland, in his memory.

“ Though cases similar to the present, of five children born at once, are still more uncommon, and though Haller’s assertion of their not happening above once in a million of births, may be reckoned a very moderate calculation, yet we are not altogether without such instances in this country.

“ From the Gentleman’s Magazine we learn, that on the 5th of October, 1736, a woman at a milk-cellar in the Strand (London) was delivered of three boys and two girls at one birth; and that in March, 1739, at Wells, in Somersetshire, a woman was delivered of four sons and a daughter, all alive, all christened, and all then seeming likely to live.

“ In the *Commercium Literarium Norimbergense* for the year 1731, we have two such cases; one happening in Upper Saxony, the other near Prague, in Bohemia, in each of which five children were born and christened, all of whom were arrived to that equal degree of maturity, which rendered it probable they were all conceived about the same time.

“ I learned from two foreign professors, when in London last winter, that they had each heard of a



3683. One of the ovaria and oviducts of an Ewe, at a later period after impregnation ; the parts have been minutely injected : the very vascular mamilloid process on the superficies of the ovarium, indicates the point whence

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case of five children born near Paris, and near Ghent, in Flanders ; but the particulars not being sent as promised, I presume they may have been misinformed.

“ When we advance further, we get into the region of tradition and improbability ; and it would ill become me to trouble a Society, whose professed object is truth and science, with the numerous and wonderful relations which many grave and learned authors have recorded as facts they themselves believed ; yet I still think we have no authority to reject absolutely every relation of this kind, when Ambrose Parè, a very honest though credulous man, tells us that in his time, in the parish of Sceaux, near Chambellay, between Sarte and Maine, the mother of the then living lord of the noble house of Maldemeure had in the first year of her marriage brought forth twins, in the second triplets, in the third four, in the fourth five, and in the fifth year six children at one birth, of which labour she died ; and when he adds, that of these *last six* one is yet alive, and is now lord of Valdemeure, how can we disbelieve this circumstance ? This story may very possibly be inaccurately stated, yet the whole cannot be a fiction, as it was published among the very people, and in the age when it happened, and never has been since contradicted, so far as we know. Though the wonderful regularity of the progress gives an appearance of fable to the whole, yet we must believe the thing to be possible ; and that this then-existing lord might be the only one of the six who lived long enough to be born at the full time, in a mature state ; the whole, or most of the other five, as we have sometimes seen in cases of twins, having been born as dead abortions, which had never arrived to a bulk sufficient to interfere with his growth.

“ I leave the learned to pay what degree of credit they please to the wonderful relations we read of the extreme fertility of the women of Egypt, Arabia, and other warm countries, as recorded by Aristotle, by Pliny, and by Albucasis, where three, four, five, and six children are said to have been frequently born at once, and the greatest part of these reared to maturity ; and will only say, that though a late traveller, M. Savary, gives ample testimony of the extreme general fertility of Egypt in all vegetable and animal productions, and particularly of its abundant population, he mentions nothing of the numerous births recorded by the ancient naturalists and historians.

“ Of still more fruitful births, I will pass over a number of instances which I could adduce from Johannes Rhodius, Lucas Schroeckius, Caspar Bauhin, Johannes Helvigijs, Bianchi, and others, and finish with one case more, recorded by Petrus Borelli in his *Second Century of Observations*, published at Paris in the year 1656 ; a collection, indeed, filled with many wonderful stories, though by a man of equal integrity and ingenuity : he tells us, that in the year 1650, just five years before, the lady of the then present Lord Darke produced at one birth eight perfect children, which he owns was a very unusual event in that country.

“ I think it totally unnecessary to pursue this inquiry further, but must observe, that the present is the only case I have found where the children were all females ; that the males have in all the other cases been at least equal, and generally the most numerous ; that in many of them, at least a part was dead born ; and that most commonly the rest died in a short time. It is thence clear, that those numerous births are certainly unfavourable to population, as very few indeed of those children can be carried to

the impregnated ovum has escaped; the orifice is now cicatrized; two parallel incisions have been made through the ovarium, one through the centre, the other by the side of the mammiloid prominence; both of them exhibit the large size and spherical form of the thickened and vascular proper tunic of the ovisac which forms the corpus luteum; its periphery is connected with a thin layer of cellular tissue, of a looser kind than that which constitutes the proper stroma of the ovary: the remains of the original cavity of the ovisac may be seen a little below the centre of the corpus luteum; it is not lined by a distinct tunic, but is occupied by a reticular cellular membrane: the substance of the ovarium, beneath the corpus luteum, consists chiefly of a plexus of large vessels.

3684. The two ovaria of an Ewe, minutely injected and bisected: in one of these is a corpus luteum; it consists, as in the preceding preparations, of the vascular and hypertrophied proper tunic of the ovisac, the folds of which have coalesced, and have thus obliterated the original cavity of the ovisac.

3685. The ovarium and oviduct of an Ewe, at apparently eight weeks after impregnation; two impregnated ova have escaped from this ovarium, which is bisected to show the ovisacs obliterated by their lobulated and dense parenchymatoid proper tunic, as described in the previous preparations. The original cavity of the ovisac is reduced to a linear, white, ligamentous

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near the full period of pregnancy, and fewer still to that degree of strength that admits of their being reared, where more than two are born at one time.

“As from Mr. John Hunter’s very curious Experiments and Observations, lately read to this Society, on the Procreation of Swine, we are led to believe, that a certain determined number of ova capable of receiving male impregnation, are originally formed in each ovarium, and which number, when exhausted, the female constitution has no power to renew; if this be the true account of the oeconomy of nature in this particular, which has every appearance of probability, those numerous births must occasion a very fruitless profusion and waste of the human race, and become every way detrimental to its increase.

“From the united testimony of all the foregoing cases, it is undeniably clear, that the females of the human species, though most commonly uniparous, are, in certain circumstances to us unknown, every now and then capable of very far exceeding their usual number; and, I must again repeat, that it does not appear that we can set any bounds to the powers of nature in that respect; or pretend, as some have done, with certainty to say what may be the utmost limits of human fertility.”

trace, from which lines radiate into the obliterating substance, and indicate the original interspaces of the projecting folds of that substance.

3686. A similar preparation, uninjected ; what remains of the original cavity of the ovisac is the mere interspace of the centripctally-developed encroaching folds of the thickened parenchymatous tunica propria of the ovisac, by the confluence and coadhesion of which it is finally obliterated.
3687. The ovarium, oviduct, and corresponding extremity of the uterine horn of a Cow (*Bos Taurus*, LINN.) : the ovarium is bisected, exposing some of the ovisacs, enlarged and in the natural state before impregnation ; and a vacated one, of which the proper membrane has become thickened and converted in the usual parenchymatoid substance, but which has not obliterated the cavity of the ovisac : the two halves of the divided ovarium are kept apart by a bristle, the extremities of which rest in the cavity of the modified ovisac. A black bristle is inserted into the abdominal aperture of the Fallopian tube, the course of which has been rendered distinct by the red injection which has been thrown into it.
3688. The ovarium of a Cow, killed during the period of uterine gestation ; it is described in the original Manuscript Catalogue as having had a slink-calf *in utero*, but the size of the embryo is not stated ; from the appearances of the ovarium it may be concluded, that not many weeks had elapsed since impregnation took place : the ovarium is bisected ; nearly the whole of its substance is occupied by the corpus luteum ; the place where the ovum has escaped is indicated by a mammilloid prominence, formed by the confluence or cohesion of the tumid and everted margins of the ruptured orifice of the thickened and vascular membrane of the ovisac, as shown in the Sheep, No. 3682. Notwithstanding the period which has elapsed since the preparation was first immersed in alcohol, the colour of the mammilloid eminence still differs from that of the ordinary unbroken surface of the ovarium, as it is not covered by the fibrous or albugineous tunic of the ovarium. A vertical section of the corpus luteum has been made through the middle of the mammilloid eminence ; the original cavity of the ovisac is indicated by a white linear trace, leading from the middle of the cut surface of the mammilloid eminence to the centre of the cor-



pus luteum, and slightly expanding as it proceeds; white lines diverge from this trace in different directions into the substance of the corpus luteum, indicating the original surface of the folds of the vascular parenchymatoid thickened membrane of the ovisac, by the centripetal growth of which the cavity has been obliterated, and converted into a corpus luteum. The exterior of the ovisac, by its pressure upon the adjoining stroma of the ovary, has become invested with a thin layer of cellular tissue; and the secretion between this layer and the stroma, kept up probably by the stimulus of the same pressure, renders the removal of the corpus luteum easy, and the surface from which it is detached smooth, like that of a serous surface, as is shown in No. 3709.

3689. The two ovaria of a Cow, killed apparently at an early period of gestation; the lower ovary in the bottle is that from which the impregnated ovum has escaped; a longitudinal section has been removed from it. In its size, in the form and condition of its mammiloid eminence, in the linear radiated trace of the original cavity, and in its mode of connection with the ovary, this corpus luteum resembles the preceding one: adjoining it is an unimpregnated ovisac of large size, from which the ovarian vesicle, or 'internal membrane of the Graafian vesicle,' and its contents, have been removed, and a bristle substituted. It is the thin, vascular, proper tunic of the ovisac, or 'external membrane of the Graafian vesicle,' here exhibited, which, by its growth and metamorphosis after the escape of the impregnated ovum, constitutes the corpus luteum. The other ovary shows the ordinary appearance of that gland.
3690. The ovary of a Cow, exhibiting the corpus luteum, resembling in all its conditions those previously described; it has been bisected through the middle of the mammiloid eminence.
3691. The ovary of a Cow, bisected and exhibiting a corpus luteum similar in all its essential anatomical conditions with those last described; it is stated in the Manuscript Catalogue to be from a Cow in which impregnation had taken place, and the calf was a little advanced.
- 3691 A. The right ovary and oviduct of a Cow, which had twin foetuses that died, and remained *in utero* two years; the two impregnated ova have

escaped from the same ovarium, which is bisected, showing the ruptured ovisacs obliterated as usual by their thickened vascular parenchymatoid tunic : some fine white ligamentous radiated fibres indicate the remains of the cavity of the ovisac in one of the corpora lutea, and a line of similar substance may be traced from the obliterated cavity to the periphery of the ovarium : the exterior of the corpus luteum is invested with a thin capsule of cellular membrane, somewhat denser than the stroma ovarii, with which it is connected by a lax cellular tissue. The mammilloid eminence, on which the original cicatrix of the ovisac was situated, has now subsided. The unusual length of time during which the 'corpora lutea' have remained of large size in the present instance, doubtless depends upon the circumstance of the ovarium not having been subjected to the stimulus of the preparation of a subsequent ovum for impregnation, in consequence of the retention of the fœtuses *in utero* ; for under ordinary circumstances, in the Cow, the corpus luteum decreases slowly during the progress of gestation, but very rapidly after its completion, and when the activity of the vascular system of the ovary recommences.

*Presented by William Lynn, Esq.*

3692. The ovarium of a Sow (*Sus domesticus*, LINN.), removed ten days after coitus : the ovisacs from which the impregnated ova have escaped have been laid open : the external aperture leads to a small cavity, apparently lined by a flocculent cellular membrane, which is immediately surrounded by a thick layer of the compact substance of the altered ovisac, which adheres by the external surface to the laxer cellular stroma of the ovary.
3693. A section of the ovarium of a Sow, at a later period after impregnation, showing ovisacs in different stages of growth ; in a small one may be observed an ovarian vesicle with the membrana granulosa, which together form the lining of the proper ovisac or external membrane of the Graafian vesicle ; the vacated ovisacs are obliterated by the same compact, organized, parenchymatoid substance, which may be seen encroaching upon the cavities of the emptied ovisacs in the preceding preparation.
3694. The ovarium of a Sow, which has been minutely injected, removed apparently a short time after impregnation ; the ovum has escaped from some

of the ovisacs, and the orifice is supported on a nipple-like prominence, formed by the vascular and tumid membrane of the ovisac, which is everted at this part; in one instance the non-vascular secretion or coagulum which has filled the ovisac after the escape of the ovary still protrudes through the aperture; in another instance the aperture of the vascular mamilloid prominence seems to have been closed, but the cavity which contained the ovum remains unobliterated; in a third instance, where the emptied ovisac or 'corpus luteum' has been bisected, the cavity which contained the ovum is lined by a thin vascular membrane, but the principal part of the corpus luteum consists of the thickened parenchymatoid tunica propria before described.

3695. The other ovarium of apparently the same Sow, the ovisacs presenting similar conditions; the aperture by which the ovum has escaped is indicated in each by a small round non-vascular spot: in one of the corpora lutea, which has been vertically bisected, the cavity of the ovisac is nearly obliterated by the centripetal growth of the firm vascular tunica propria, which, advancing from each side and from below, has reduced the vertical section of the cavity to a linear tri-radiate figure; in other ovisacs from which sections have been removed, the remaining cavity presents the same size as in the corpora lutea of the preceding specimen, but is lined by a non-vascular cellularity.
3696. A section of the ovarium of a Sow, sixteen days after the coitus, injected, showing the condition of the vacated ovisacs or corpora lutea at that period; five of these bodies are bisected; in one the section passes vertically through the cicatrix and the cavity left after the escape of the ovum; the cavity is reduced to a linear fissure by the centripetal growth of the firm, vascular tissue of the membrana propria: the folds of this tissue have begun to adhere to each other at the centre of the ovisac, the progress of the obliteration being apparently centrifugal in this instance: a distinct lining-membrane of the remaining cavity cannot be discerned; its inner surface is stained by extravasated injection. A transverse section has been removed from the corpus luteum below the one just described; here the remains of the original cavity of the ovisac are



occupied by either a coagulated, mucous secretion, or a loose cellulosity: the plicated disposition of the firm vascular substance which encroaches on that cavity is well displayed: a similar appearance of the division of this substance into lobes ('acini' of Haller\*), the free convex borders of which project towards the centre of the ovisac, is likewise presented in two other corpora lutea which have been transversely bisected at a point nearer their base than the one last described.

3697. A longitudinal section of the ovarium, with the corresponding oviduct of a Sow; the section exposes five corpora lutea, in four of which the cavity of the ovisac is obliterated, as in the preceding preparation: in a fifth, a linear fissure extends from the situation of the aperture by which the ovum escaped, to the centre of the corpus luteum; the sides of this fissure have not cohered: the parts are minutely injected, and the great vascularity of the parenchymatoid tunic of the ovisac, forming the corpus luteum, is demonstrated.
3698. A section of the ovarium of a Sow, at apparently a later period after the coitus: the cavities of the five ovisacs, converted into the corpora lutea by the parenchymatoid modification and centripetal growth of the vascular tunica propria before described, have been quite obliterated: this substance, which is here minutely injected, seems to adhere immediately by its external surface with the cellular stroma of the ovary, and is not connected therewith by a thin layer of condensed cellular tissue, as in the Cow, No. 3688.
3699. The ovarium and adjoining parts of a Mare (*Equus Caballus*, LINN.). A longitudinal section has been removed from the ovarium, and a thin slice is reflected from the cut surface; this exposes the cavities of a few ovisacs, which are lined by the ovarian vesicle, and from which the ovum and its surrounding fluid have been removed; it likewise shows three corpora lutea, in each of which the original cavity of the ovisac has been completely obliterated by the firm, vascular, lobulated or plicated tissue, which is developed from the circumference to the centre of the vacated

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\* *Opera Minora*, tom. ii. p. 428.

ovisac. The folds of this tissue present a more complicated, cerebriform arrangement than in the Sow or Cow: the three corpora lutea here preserved show the progressive condensation and absorption of this tissue in the Mare.

3700. The ovarium and oviduct of a Mare, four weeks after impregnation: the ovarium is laid open by an incision through the vacated ovisac, a small part of the cavity of which still remains unobliterated by the surrounding plicated dense tissue; the cavity is occupied by a loose, reticular cellularity: the cerebriform plication of the parenchymatoid tunic of the vacated ovisac is well displayed in this preparation.
3701. The ovarium, Fallopian tube, and contiguous portion of the uterine horn of an Ass (*Equus Asinus*, LINN.). A section of the ovarium has been made through a corpus luteum, in which the convergence of the folds of the modified tunic towards the centre of the cavity of the ovisac, which has thereby been obliterated, is clearly displayed; a small quantity of a loose cellular tissue with a small central cyst or cavity, occupies the remains of the vacated ovisac; the substance in contact with the reticular cellularity presents a darker colour than the peripheral portion of the corpus luteum: there is no mammiloid eminence to indicate the place where the impregnated ovum escaped\*.

\* The appearances of the corpus luteum presented in this preparation correspond with those described by Hunter in the subjoined Note:—

“On Friday the 2nd of October, 1789, my she-Ass took the male, and on the Tuesday following I killed her about seven in the morning, making in all what is called four days, but only ninety-two hours. The uterus was immediately taken out, and it was observed that one ovarium was much larger than the other. It was injected on both sides, and in both veins and arteries. When injected, the increased ovarium was much redder than the other, as also was the horn of the uterus on that side. I cut through the small ovarium first, to see if it led to the better exposing of the other.

“I then slowly divided the other, in which I cut across several small hydatids” (ovisacs), “but I came to a glandular substance distinct from the surrounding parts in structure; and dividing that, along with the other parts, I came to a kind of cavity in which there seemed to be a kind of fine and loose cellular membrane, in the centre of which was a small rounded body, which was a little bag; for in dividing this part I had cut off a little of the side of the bag, into which hole a small globule of air had entered. Within this was an oblong body, which, when taken out, looked like a little coagulable lymph.”—*Hunterian Manuscript*.

3702. The ovarium of a Quadruped, the species of which has not been recorded : it has recently been impregnated, and a great portion of the ovarium is occupied by a single corpus luteum ; the altered parenchymatoid tunic of the ovisac appears unusually dense ; the small remains of the primitive cavity of the ovisac, having a smooth surface, may be seen on one side of the section ; there is no trace of the original mammilloid eminence, and the remaining cavity of the ovisac is not lined by a distinct membrane.
3703. Two ovaria with their oviducts and corresponding extremities of the horns of the uterus of an unnamed Quadruped, but which, from the form and structure of the pavilions and the ovaria, and their relative positions to each other, must have been a species of *Canis*, most probably the *C. familiaris*. She has recently been impregnated ; one ovarium presents the still patent orifices of five vacated ovisacs ; four of these are left entire ; their margins, though raised and slightly thickened, are much less tumid and everted than in the Sheep, No. 3682 : a small portion of coagulum protrudes from each ; the fifth ovisac has been vertically bisected, and one of the sections removed ; the original cavity of the ovisac may be traced from the external aperture, extending through the middle of the corpus luteum ; it contains a small quantity of coagulum, but the plicæ of the thickened vascular parenchymatoid membrane of the ovisac have nearly come in contact in the progress of their centripetal development ; it only requires that they should mutually cohere, in order to complete the obliteration of the original cavity of the ovisac : in the other ovarium a section has been removed from each of the vacated ovisacs, which exhibit the same conditions. A bristle is inserted into the orifice of the ovarian capsule, which includes the pavilion and ovarium, but of which the greater part has been dissected away to show these parts.
3704. The ovarium, oviduct, and corresponding portion of the horn of the uterus of a species of *Canis*\*, most probably a pregnant Bitch : half of

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\* This preparation is called in Home's Catalogue, "ovarium and horn of the Sow:" that it does not belong to that animal, but to a species of *Canis*, is proved by the anatomical conditions of the ovarium, ovarian capsule, and pavilion or fimbriated extremity of the Fallopian tube ; as also by the unequivocal indications in the portion of uterus preserved of a placental structure, and of the circular form of the placenta.



the ovarian capsule has been cut away to expose the contained ovarium and pavilion: gestation has been further advanced in this than in the preceding case; the orifices of the vacated ovisacs have cicatrized; from two of these a section has been removed to show the complete obliteration of the original cavity of the ovisac by the centripetal development and mutual cohesion of the thickened parenchymatoid folds of the membrane of the ovisac; the place of attachment of the placenta of three embryos in the portion of uterus here preserved, which is laid open, is very obvious.

3705. A section of the ovarium of a young Woman, in the fourth week of pregnancy, from whom the preparations, Nos. 2590, 2591, and 2592 were taken: it includes a slice of the middle of the corpus luteum, with part of the surface of the still unobliterated cavity of the ovisac; this presents no appearance of being lined by a distinct membrane, but the exposed surface forms part of, or is closely adherent to the substance of the corpus luteum, which consists of the thickened parenchymatoid proper tissue or tunic of the ovisac; this substance occupies, as before described, more than one-third of the entire ovarium: immediately above it in the preparation are the evident remains of a previous corpus luteum, consisting of the peculiar thickened parenchymatoid plicated membrane, with the central surface of its folds mutually coherent by means of a whiter and denser substance, and the whole surrounded by a vascular layer of the stroma ovarii. Several unimpregnated ovisacs are likewise laid open; in three of these the ovarian vesicle and more or less of its granular contents are preserved; in a fourth it has been removed, and the thin tunica propria of the ovisac is shown, which, after impregnation, becomes the seat and subject of those changes and developments by which the corpus luteum is produced.

3706. A section of a Human ovarium, at the ninth month of pregnancy: it has been minutely injected, and shows, in close juxtaposition, an ovisac which has contained an ovum ripe for impregnation, and the ovisac from which the last impregnated ovum has escaped. The parietes of the unimpregnated ovisac are comparatively thin and unvascular; its cavity, on

the contrary, is considerable : in the vacated ovisac the parietes are thick, vascular, and plicated, from the change in the membrane already described, whilst the cavity is obliterated by a dense, white, unvascular tissue.

3707. The ovarium of a Human Female, bisected to show a large corpus luteum : the trace of the original cavity of the ovisac presents the form of a small, white, opaque, irregular streak of condensed cellular tissue, from which lines radiate into the substance of the corpus luteum, indicating the interspaces of its folds, which are now coherent together.
3708. A Human ovarium, bisected, showing a corpus luteum similar in size and anatomical conditions to the one last described.
3709. A Human ovarium and oviduct : the ovarium is bisected, and exhibits a corpus luteum similar in size and general anatomical conditions to the two preceding specimens : one half of the divided corpus luteum has been turned out of its ovarian nidus, showing the smooth surface of that cavity and the thin layer of condensed cellular tissue due to the pressure of the corpus luteum, and by which it is connected with the stroma ovarii.
3710. A Human ovarium and oviduct : the ovarium is bisected, showing a corpus luteum similar in size to the preceding ones ; the white central substance which sends out radiated processes into the corpus luteum, presents an indication of the original cavity of the ovisac in its centre.
3711. A Human ovarium and oviduct, finely injected : the period of gestation is not noted. The bisected ovary shows well the vascularity and plication of the proper membrane of the ovisac, which constitutes the corpus luteum ; these folds have not, however, come wholly into contact in the progress of their centripetal growth ; they still surround a conspicuous cavity, which is lined by a vesicle, perhaps the original ovarian vesicle which has not been expelled after the dehiscence of the ovisac and the escape of the ovum and its tunica granulosa and retinacula ; it is probably also due to the retention of this vesicle that the lacerated orifice of the ovisac is not cicatrized : a section of this retained cyst may be seen in the cut surface of the corpus luteum opposite the left hand of the

observer; its exterior is connected by a loose cellulosity with the projecting folds of the corpus luteum, and its cavity contains a substance which has received the injection.

3712. An ovarium and oviduct of a Female at an advanced stage of pregnancy, or immediately subsequent to parturition: the parts have been injected; the ovarium is bisected, and the corpus luteum is exhibited; there is a small remnant of the original cavity of the ovisac immediately surrounded by a thin layer of the white unvascular substance, which adheres to the central surface of the altered parenchymatoid tissue of the ovisac, and sends its radiated processes into the interspaces of the coherent folds of that substance.
3713. The ovarium and part of the oviduct of a Human subject, apparently removed at an advanced stage of gestation, or soon after parturition: the ovarium containing the corpus luteum has been bisected; in its centre is a cavity three lines in diameter; it is lined by a delicate membrane having a smooth serous surface, which is attached by a loose cellular tissue to a layer of dense white substance coherent with the central surface of the thickened, vascular, parenchymatoid, proper membrane of the ovisac.
3714. The ovarium, oviduct, and a section of the uterus of a Human subject at the close of gestation: the ovarium has been bisected, and a corpus luteum divided nearly through its centre; it exhibits a cavity analogous to that of the preceding preparation, but larger, and with its lining membrane more immediately coherent with the dense white layer of substance covering the central surface of the corpus luteum or parenchymatoid tunic of the ovisac.

## SERIES XVII. Fœtal Peculiarities.

[Transitory organs or conditions of organs in the course of the development of the Mammalian Fœtus.]

3715. A fœtal Dog (*Canis familiaris*, LINN.), with the parietes of the left side of the abdomen removed to show the vitelline duct and artery passing to the umbilicus; also the narrow elongated urinary bladder, or internal



dilatation of the pedicle of the allantois, and the remains of the pedicle continued as the urachus from the apex of the urinary bladder to the umbilicus, with the umbilical or hypogastric arteries and the umbilical vein, through which a bristle is passed.

3716. A foetal Dog, with the ventral parietes of the abdomen and the small intestines removed, showing the narrow elongated form of the urinary bladder and its continuation by the urachus into the umbilical cord. The position of the ovaria attached to the lower ends of the kidneys may be observed; they are not yet inclosed in the peritoneal capsules; the passage of the round ligaments to the abdominal apertures is shown; a bristle is placed behind that of the left side; the slender filamentary condition of the horns of the uterus are likewise worthy of notice.
3717. The heart of a young Porpoise (*Delphinus Phocaena*, LINN.), soon after birth: part of the walls of the auricles and ventricles, and of the aorta and pulmonary artery, have been removed, showing the foramen ovale and its valve; the oblique passage between the two auricles still remains open, as also the ductus arteriosus between the pulmonary artery and aorta, which is in progress of obliteration; the internal structure of the ventricles is well displayed in this preparation.
3718. A section of the ventricles of the heart of a foetal Calf (*Bos Taurus*, LINN.), with the origins of the aorta and pulmonary artery, showing the great thickness of the walls of those vessels, which in this respect are nearly equal at this period.
3719. The heart of a Human foetus, in which the apex has been removed to show the nearly equal thickness of the walls of the ventricles at this period, those of the left ventricle being, however, denser or less reticulate; from the capacity of the ductus arteriosus, the descending aorta appears rather as a continuation of the pulmonary artery than of the arch of the aorta.
3720. A foetal Armadillo (*Dasypus Peba*, Cuv.), with the ventral parietes of the abdomen and the small intestines removed, principally to show the abdominal position of the testes, which they retain throughout life in this species.

3721. The lower moiety of a foetal Calf, with the ventral parietes and all the abdominal viscera removed, excepting the testes and urinary bladder, the kidney, suprarenal glands and rectum; the preparation is made to show the abdominal position of the testes, which are suspended by a duplicature of peritoneum analogous to a broad ligament below the kidneys: the serous duplicature divides below the testes, one fold being continued with the vas deferens behind the neck of the bladder.
3722. A foetal Lamb, similarly dissected, to show the analogous position of the ovaria, which here, as in all Mammalia, they retain throughout life.
3723. A testis of a Foal before it has passed into the scrotum, with the abdominal ring, and the peritoneal pouch continued through that ring along with the gubernaculum to the scrotum; the connexion between the lower extremity of the testis and the gubernaculum is here shown; the gubernaculum exhibits a fibrous structure, which is probably contractile.
3724. The opposite abdominal testis of the same Foal, with the abdominal ring and scrotal pouch of peritoneum inverted.
3725. The right testicle of a Ram (*Ovis Aries*, LINN.), which never passed into the scrotum. This testicle is figured *in situ* in the Animal Œconomy, 4to, ed. 2. pl. iv., where the parts are thus described by Hunter:—
- “ A side view of the pelvis of a young Ram, to show the right testicle remaining in the cavity of the abdomen, after the left had come down, but which is removed with that half of the pelvis. The testicle which lies in the loins is flatter than common, and is only attached by one edge, which is principally by the epididymis; there is also a ligament passing from the upper part of the common attachment which binds the testicle to the posterior part of the abdominal muscles; this is analogous to the ligament that attaches the ovarium to the same part in the female quadruped. The epididymis passes along the outer or posterior edge, and at the lower part becomes larger and pendulous, making a little twist upon itself where it becomes vas deferens. The vas deferens is a little contorted, and passes down obliquely over the psoas muscle to the bladder. From the lower end of the testicle there is a ridge continued along the psoas muscle through the abdominal ring, going on to the scrotum,

which is most probably the gubernaculum; but it was so much covered by a hard suety fat, that I could not exactly ascertain its structure: at the lower part of this ridge, about an inch and a half from the ring, I found the termination of the cremaster, which was a tolerably large muscle; part of its fibres seemed to arise in common with the internal oblique, while the rest appeared to come from the psoas and iliacus internus behind it; the outer portion passed inwards and downwards, and spread upon the fore-part of the ridge, or gubernaculum, where the greatest part of its fibres were lost, and the rest of them were continued into the back part of it. The posterior portion got upon the inside of the ridge, and was lost in the same manner as the former." *Loc. cit.* p. 29.

3726. The lower part of the trunk of a Human foetus, at the eighth month of gestation, with the ventral parietes of the abdomen and most of the abdominal viscera removed; the parietes of the left side of the scrotum have also been dissected away to show the left testis descended into that cavity: a bristle is passed through the peritoneal or abdominal canal along which it has passed, which still remains unobliterated: the right testis is seen resting upon the internal abdominal ring through which the gubernaculum is continued; it may have been artificially retracted within the abdomen.

3726 A. A Human testicle, which was retained within the abdomen, together with the fibrous cord or gubernaculum, which was continued from this abdominal testis through the abdominal rings into the scrotum: the arteries and veins have been injected with quicksilver, and the preparation has been dried and put up in oil of turpentine: the substance representing the gubernaculum appears to consist chiefly of a plexus of vessels.

*Presented by Thomas Blizard, Esq., F.R.S.*

3727. The ovaria, Fallopian tubes, and uterus of a human Infant, showing the narrow elongated angular form of the ovaria, and their smooth external surface at this period.

3727 A. Two embryos of the Hog and two of a Sheep at an early period of gestation, dissected to show the large size of the transitory kidneys or 'corpora Wolffiana': the small bodies situated on the anterior part of



the inner surface of the Wolffian bodies are the essential genital glands; those which are situated at the posterior part of the Wolffian bodies are the rudiments of the true kidneys: in the lower specimens it will be seen that the 'corpora Wolffiana' have formed the largest of the abdominal viscera at this period.

*Prepared by Mr. Owen.*

- 3727 B. Two embryos of a Cow, dissected and injected to show the Wolffian bodies in the course of absorption. In the upper specimen, which is a male, the supra-renal body, kidney, Wolffian body and testis are seen in their natural relative positions: the testis is removed on the right side, and the small vascular plexuses, analogous to the Malpighian corpuscles of the kidney, are shown in clusters on the inner side of the corpus Wolffianum. In the lower specimen, which is a female, the ovaria are shown resting upon the anterior and inner side of the Wolffian body. The oviduct and slender uterine tube run parallel and in close contact with the duct of the Wolffian body; they unite at the point which subsequently corresponds with the vagina, and where, in the mature animal, the traces of the Wolffian ducts exist as the canals of Malpighi and Gærtner. See Nos. 2763, 2776, and 2777 B.

*Presented by Jos. Toynbee, Esq., M.R.C.S.*

- 3727 c. Two foetuses of a Cow, at a later period of gestation, similarly dissected and injected, showing the remains of the nearly absorbed Wolffian body occupying the duplicature of peritoneum which forms the broad ligament of the ovary in the lower specimen, and the analogous support of the testis in the upper one.

*Presented by Jos. Toynbee, Esq., M.R.C.S.*

3728. A foetal Dolphin (*Delphinus Delphis*; LINN.). The extremity of the lower jaw with the tongue is cut off, showing the alveolar groove on the inside of the upper jaw, and likewise a section of the corresponding groove in each ramus of the lower jaw, into which a process of the investing gum is continued: the ventral parietes of the thorax and abdomen have been removed; the heart and the large thymus gland in front of the great vessels are exposed *in situ*: the fore-part of the pericardium has been removed, and the ventricles exhibit the undivided apex which characterizes the heart of the adult dolphin. A longitudinal section has been removed from the right

lung to show its dense tissue at this period ; the large liver is displayed *in situ* : a bristle is passed behind the umbilical vein ; another bristle is placed behind the urachus and the hypogastric arteries. The convolutions of the small intestine, the racemose kidney of the left side, and the corresponding ovarium are shown : the sheath of the clitoris is more prominent than in the adult. On the portion of the umbilical cord which is preserved, several of the pedunculate gland-like corpuscles of the amnios may be seen ; a bristle is inserted into the single crescentic blow-hole.

3729. A foetus of a Walruss (*Trichechus Rosmarus*, LINN.), about six inches in length, with the ventral parietes of the thorax and abdomen removed. The thymus gland covers the origin of the great vessels of the heart and part of both auricles : the pericardium is removed from the front of the heart, showing its breadth and flatness, and the separate apex of each ventricle : the large lobulated liver is shown *in situ* : the umbilical vein is cut across close to that gland : the wide urachus and the two hypogastric arteries may be seen transversely divided : the racemose kidney of the left side is displayed *in situ* : the small intestines have been removed, and bristles are inserted into the divided jejunum and ileum. With respect to the external condition of this foetus, it may be observed, that the fissure of the eyelids is closed, and also the external aperture of the ear : the labial bristles are already developed upon the broad and truncated muzzle.
3730. The thoracic viscera of a Human foetus, about the fifth month of gestation, showing the two large oblong subcompressed lobes of the transitory gland called the thymus, which conceals the upper part of the heart and great vessels.
3731. The anterior half of the coats of the eye of a Human foetus of the seventh month, showing the veins of the transitory membrane which closes the pupillary aperture and the eyeball prior to the development of the cornea, and continues to the present period entire ; it is termed the membrana pupillaris ; and some remnants may be generally seen even at the close of gestation : the vessels of the choroid have been minutely injected, showing that those of the membrana pupillaris are derived from the ciliary arteries.

- 3731 A. A similar preparation, with the lens and a part of the vitreous humour and its membrane attached: the cornea is reflected upwards, and shows the great vascularity of the membrana pupillaris. *Mus. Heaviside.*
- 3731 B. The iris and membrana pupillaris of a Human fœtus, at the sixth month of gestation, dried and preserved in oil of turpentine.  
*Presented by Prof. Jacob, M.R.I.A.*
- 3731 C. The iris and remains of the membrana pupillaris of a Human fœtus, at the eighth month of gestation, minutely injected, dried and preserved in oil of turpentine.  
*Presented by Prof. Jacob, M.R.I.A.*
3732. The choroid tunics of the eye of a Human fœtus, minutely injected, exhibiting the remains of the 'membrana pupillaris.'
- 3732 A. The iris and part of the choroid and membrana pupillaris of a Human fœtus; there is a small circular aperture in the centre of the membrana pupillaris, which is in progress of absorption.  
*Presented by Sir William Blizard, F.R.S.*
3733. The anterior part of the sclerotica and choroid of a Human fœtus at the full period, minutely injected, showing some shreds of the membrana pupillaris still attached to the free margin of the iris.
- 3733 A. The anterior part of the choroid, with the iris and ciliary processes of a Human infant, ten days after birth; a few fine filaments or vessels of the membrana pupillaris are still discernible.  
*Presented by Prof. Jacob, M.R.I.A.\**
3734. The tunics of the eye of a Human infant, with the cornea transparens removed; no trace of the membrana pupillaris remains.
3735. The iris, ciliary processes, and part of the choroid of an adult, minutely injected to show the absence of the membrana pupillaris.
3736. A section of the coats of the eye of a Human fœtus, very minutely injected; it shows the very great vascularity of the choroid; the iris and membrana pupillaris have been cut away.

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\* The preparations of the *Membrana pupillaris*, presented by Dr. Jacob, are described in his Paper in the Medico-chirurgical Transactions, vol. xii. 1823.



SERIES XVIII. Mammary organs, and parts having an analogous office.

3737. The anterior half of a Pigeon (*Columba Ænas*, LINN.), denuded of its feathers, with the bilobed crop or ingluvies laid open, and exposed *in situ*, showing the thin coats and smooth and even internal surface of the crop at the non-breeding season.
3738. A similar preparation of a Pigeon at the breeding-season, with the cavity of the crop similarly exposed *in situ*, showing the increased thickness, plication, and glandular structure of the lining membrane of the ingluvies at that season.
3739. The lower portion of the œsophagus with its lateral sacculi or crop, and part of the proventriculus of a Pigeon, showing the condition of the crop at the non-breeding season.
3740. The corresponding parts of the male of the same species of Pigeon, similarly prepared to show the condition of the crop peculiar to the breeding-season in this sex, both parents contributing a nutritious secretion for the sustenance of the callow offspring. This and the preceding preparation are figured in Hunter's 'Animal Œconomy', from which work their description, with the comments of the author, are subjoined\*.

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\* " *On a Secretion in the Crop of Breeding-Pigeons for the Nourishment of their Young.*

" The nourishment of animals admits, perhaps, of as much variety in the mode by which it is to be performed, as any circumstance connected with their œconomy; whether we consider their numerous tribes, the different stages through which every animal passes, or the food adapted to the support of each, in their distinct conditions and situations. We are likewise to include in this view that endless variety in the means by which this food is procured, according to the class of the animal and the particular stage of its existence. If the food was the same through every period of the life of an animal, if every individual of a tribe lived on the same kind, and procured it by the same mode, our speculations would then admit of a regular arrangement; but when we see that the food adapted to one stage of an animal's life is rejected at another, and that animals of one class in some respects resemble those of another, by hardly having any food peculiar to themselves, the subject becomes so complicated, that it is not surprising if we are at a loss to arrange the various modes by which animals are nourished.

" Animal life may not improperly be divided into three states, or stages. The first comprehends

3741. A portion of the secretion of the thickened glandular membrane lining the crop of the parent Pigeon, together with some grains which have been swallowed.

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the production of the animal and its growth in the foetal state ; the second commences when it emerges from that state by what is called the birth, yet for a certain time must, either mediately or immediately, depend on the parent for support ; the third may be said to take place when the animal is fit, and at liberty, to act for itself. The first and third stages are perhaps common to all animals ; but there are some classes, as fishes, spiders, &c., which seem to have no second stage, but pass directly from the first to what is the third in other animals. Of those requiring a second stage, the polypus and the viviparous animals continue to derive their nourishment immediately from the parent ; while the oviparous are for some time supported by a substance originally formed with them, and reserved for that purpose.

“ There is infinite variety in the means by which Nature provides for the support of the young in the second stage of animal life. In many insects it is effected by the female instinctively depositing the egg, or whatever contains the rudiments of the animal, in such a situation, that, when hatched, it may be within reach of proper food : others, as the humble-bee and black-beetle, collect a quantity of peculiar substance, which both serves as a nidus for the egg, and nourishment for the maggot, when the embryo arrives at that state. Most birds, and many of the bee-tribe, collect food for their young ; when at a more advanced period, the task of feeding them is performed by both male and female, with an exception in the common bee, the young ones of which are not fed by either parent, but by the working bees, which act the part of the nurse. There is likewise a number of animals capable of supplying immediately from their own bodies the nourishment proper for their offspring during this second stage,—a mode of nourishment which has hitherto been supposed to be peculiar to that class of animals which Linnæus calls Mammalia ; nor has it, I imagine, been ever suspected to belong to any other.

“ I have, however, in my inquiries concerning the various modes in which young animals are nourished, discovered that all of the dove-kind are endowed with a similar power. The young pigeon, like the young quadruped, till it is capable of digesting the common food of its kind, is fed with a substance secreted for that purpose by the parent animal ; not as in the Mammalia, by the female alone, but also by the male ; which, perhaps, furnishes this nutriment in a degree still more abundant. It is a common property of birds, that both male and female are equally employed in hatching, and in feeding their young in the second stage ; but this particular mode of nourishment, by means of a substance secreted in their own bodies, is peculiar to certain kinds, and is carried on in the crop.

“ Besides the dove-kind, I have some reason to suppose parrots to be endowed with the same faculty, as they have the power of throwing up the contents of the crop, and feeding one another. I have seen the cock perroquet regularly feed the hen, by first filling his own crop, and then supplying her from his beak. Parrots, maccaws, cockatoos, &c., when they are very fond of the person who feeds them, may likewise be observed to have the action of throwing up the food, and often do it. The cock pigeon, when he caresses the hen, performs the same kind of action as when he feeds his young ; but I do not know if at this time he throws up anything from the crop.

“ During incubation, the coats of the crop, in the pigeon, are gradually enlarged and thickened, like

3741 A. The female organs of generation, and a section of the abdominal integument, with one of the mammary glands of the *Ornithorhynchus paradoxus*: the female organs are here preserved to show their quiescent state, with which the small size of the mammary gland corresponds: it consists of several elongated slender lobes, which converge towards a small oval surface or areola of the integument; this is perforated by the ducts of the mammary lobes, without being produced into the form of a nipple.

*Presented by Mr. Owen.*

3741 B. A portion of integument with the opposite mammary gland of the same

what happens to the udder of females of the class Mammalia, in the term of uterine gestation. On comparing the state of the crop when the bird is not sitting, with its appearance during incubation, the difference is very remarkable. In the first case it is thin and membranous; but by the time the young are about to be hatched, the whole, except what lies on the trachea, becomes thicker and takes on a glandular appearance, having its internal surface very irregular. It is likewise evidently more vascular than in its former state, that it may convey a quantity of blood, sufficient for the secretion of the substance which is to nourish the young brood for some days after they are hatched.

“Whatever may be the consistence of this substance, when just secreted, it most probably very soon coagulates into a granulated white curd, for in such a form I have always found it in the crop; and if an old pigeon is killed just as the young ones are hatching, the crop will be found as above described, and in its cavity pieces of white curd mixed with some of the common food of the pigeon, such as barley, beans, &c. If we allow either of the parents to feed the brood, the crop of the young pigeons, when examined, will be discovered to contain the same kind of curdled substance as that of the old ones, which passes from thence into the stomach, where it is to be digested.

“The young pigeon is fed for a little time with this substance only, as about the third day some of the common food is found mingled with it; as the pigeon grows older, the proportion of common food is increased, so that by the time it is seven, eight, or nine days old, the secretion of the curd ceases in the old ones, and of course no more will be found in the crop of the young. It is a curious fact, that the parent pigeon has at first a power to throw up this curd without any mixture of common food, although afterwards both are thrown up according to the proportion required for the young ones.

“I have called this substance curd, not as being literally so, but as resembling that more than anything I know; it may, however, have a greater resemblance to curd than we are perhaps aware of; neither this secretion, nor curd from which the whey has been pressed, seem to contain any sugar, and do not run into the acetous fermentation. The property of coagulating is confined to the substance itself, as it produces no such effect when mixed with milk.

“This secretion in the pigeon, like all other animal substances, becomes putrid by standing, though not so readily as either blood or meat, it resisting putrefaction for a considerable time; neither will curd, much pressed, become putrid so soon as either blood or meat.”—*Animal Œconomy*, 2nd ed. 4to, p. 235.



Ornithorhynchus, dissected chiefly to show the relative position of the gland and the thick cutaneous muscle, which acts as a compressor of the gland against the expanded cartilages of the ribs.

*Presented by Mr. Owen.*

- 3741 c. The ovarium, part of the oviduct, and one of the fully developed mammary glands of an Ornithorhynchus: the ovarium exhibits the condition which indicates the recent fulfilment of the uterine functions, not that of preparation for the reception of the male influence, which ought to have been the case on the theory of the ventral glands in the Ornithorhynchus having an office analogous to that of the scent-glands of the Shrew and other animals. The mammary gland measures five inches and a half in length, and between two and three inches in breadth; the length of many of the enlarged lobes is increased by irregular inflections: a portion of the skin is preserved, including the small mammary areola, on which the ducts of the mammary lobes terminate; their orifices are distinctly perceptible; but there is still not the slightest appearance of a nipple, or of any cavity in which a nipple might be concealed by inversion.

*Presented by Mr. Owen.*

- 3741 d. The ovarium, part of the oviduct, and a section of the mammary gland, with its compressor muscle and the integument supporting it; the gland exhibits, as in the preceding specimen, its full state of development: several of the elongated lobes have been successfully injected with mercury, showing their minute spherical secreting cells or cæca, of which the parenchyma of the lobule is composed: the section is made through the mammary areola, showing the convergence of the mammary ducts to that point.

*Presented by Mr. Owen.*

- 3741 e. A section of the integument with the mammary gland, mammary areola, and compressor muscle of the Echidna (*Echidna Hystrix*, Cuv.): the mammary gland exhibits its quiescent and undeveloped state; it consists, as in the Ornithorhynchus, of numerous slender lobes, but these are shorter and broader. The external indications of a mammary apparatus are as inconspicuous in this Monotreme as in the Ornithorhynchus.

*Presented by Mr. Owen.*

3742. One of the mammary glands, and the integument supporting it, with the lacteal reservoir and nipple of a large species of *Delphinus* (*Delphinus Tursio*, FABR.)\*. The gland consists, as in the *Ornithorhynchus*, of an aggregate of elongated subcompressed lobes, made up each of a similar parenchyma of minute subspherical secerning cells: the mammary duct dilates into a kind of reservoir between the gland and nipple: the nipple

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\* It was this species of *Delphinus* which Dr. Jenner dissected at Berkeley, and respecting which the following observations on the milk and mammary organs have been recorded by Hunter:—

“Of their uterine gestation I as yet know nothing; but it is very probable that they have only a single young one at a time, there being only two nipples. This seemed to be the case with the Bottle-nose Whale, caught near Berkeley, which had been seen for some days with one young one following it, and they were both caught together.

“The glands for the secretion of milk are two; one on each side of the middle line of the belly at its lower part. The posterior ends, from which go out the nipples, are on each side of the opening of the vagina, in small sulci. They are flat bodies, lying between the external layer of fat and abdominal muscles, and are of considerable length, but only one-fourth of that in breadth. They are thin, that they may not vary the external shape of the animal, and have a principal duct, running in the middle through the whole length of the gland, and collecting the smaller lateral ducts, which are made up of those still smaller. Some of these lateral branches enter the common trunk in the direction of the milk's passage, others in the contrary direction, especially those nearest to the termination of the trunk in the nipple. The trunk is large, and appears to serve as a reservoir for the milk, and terminates externally in a projection, which is the nipple. The lateral portions of the sulcus which incloses the nipple, are composed of parts looser in texture than the common adipose membrane, which is probably to admit of the elongation or projection of the nipple. On the outside of this there is another small fissure, which, I imagine, is likewise intended to give greater facility to the movements of all these parts.

“The milk is probably very rich; for in that caught near Berkeley with its young one, the milk, which was tasted by Mr. Jenner and Mr. Ludlow, surgeon, at Sodbury, was rich, like cow's milk to which cream had been added.

“The mode in which these animals must suck would appear to be very inconvenient for respiration, as either the mother or young one will be prevented from breathing at the time, their nostrils being in opposite directions; therefore the nose of one must be under water, and the time of sucking can only be between each respiration. The act of sucking must likewise be different from that of land animals, as in them it is performed by the lungs drawing the air from the mouth backwards into themselves, which the fluid follows, by being forced into the mouth from the pressure of the external air on its surface; but in this tribe, the lungs having no connexion with the mouth, sucking must be performed by some action of the mouth itself, and by its having the power of expansion.”—*Hunter on Whales, Philos. Trans.* 1787, p. 445.

[The young Whale is aided, as in the *Marsupialia* and *Monotremata*, by actions on the part of the parent, and principally by the contraction of powerful cutaneous muscles so arranged as to compress the mammary gland and expel the milk from the dilated ducts and lacteal reservoirs.]

is short and conical, and its duct, through which a portion of bougie is here passed, is concealed, when not in use, in an elliptical depression of the integument.

3743. The cutaneous mammary fossa, with the small, conical, perforated nipple, and a section of the lacteal reservoir and contiguous part of the mammary gland of a young Piked-whale (*Balæna Boops*, LINN.).
3744. The cutaneous mammary depression, nipple, and lacteal reservoir of the opposite side of the same Whale.
- 3744 A. A small portion of milk from the mammary gland of a Porpoise: it is not coagulated in a mass, but retains its minutely-granular condition; the granules, from their superior weight, have subsided to the bottom of the bottle below the alcohol. *Presented by Mr. Owen.*
3745. One of the nipples of a Quadruped: bristles have been passed through three of the lactiferous ducts, showing their distinct terminations at the end of the nipple.
3746. A section of the abdominal integument with two of the nipples of a Quadruped, probably a Sow, at the period of lactation: bristles are passed through the two large lactiferous ducts which traverse and open upon each nipple.
3747. One of the nipples of a Sow at the period of lactation, from the side of which a section has been removed.
3748. The extremity of the nipple of a Quadruped at the period of lactation, at the base of which several bristles have been introduced into the lactiferous ducts.
3749. A portion of the integument, including the base of the 'preputium clitoridis,' and the two nipples situated one on each side of that part of the Mare.
3750. A portion of skin, with two small nipples, and the corresponding mammary glands, said to be of the Horse: bristles are inserted into the two lactiferous ducts which terminate at the end of each nipple.
- 3750 A. The two teats, with the connecting portion of integument and a portion of the mammary gland of the Rhinoceros (*Rhinoceros Indicus*, CUV.).



Each teat, in the present unexcited state, is short, subcylindrical, and obtuse or truncate at the extremity, which is perforated by twelve lacteal orifices. The mammary gland is described by Sir Astley Cooper as "forming a thin and expanded substance placed under the skin of the abdomen. The lactiferous tubes become arborescent in the gland, and terminate in numerous milk-cells\*." The teats are inguinal in their position, and were situated fourteen inches anterior to the vulva.

*Prepared by Sir Astley Cooper, Bart., F.R.S.*

- 3751. A section of the mammary gland and one of the teats of a Cow: it shows the receptacular cavity in the substance of the teat, and its contracted tubular terminal aperture.
- 3752. A Bandicoot Rat (*Mus giganteus*, SHAW), showing the number and position of the nipples, which are six on each side, extending from the pectoral to the inguinal region.
- 3753. A Mouse (*Mus musculus*, LINN.), showing the number and situation of its nipples; these are three on each side of the pectoral, and three on each side of the inguinal region.
- 3753 A. A Bat (*Phyllostoma*), showing four nipples, one on each side of the pectoral region, and the other two situated upon the pubic region.
- 3754. A large species of frugivorous Bat (*Pteropus*), showing its two large nipples situated one beneath each axillary region: the cuticle and hair have been removed from this specimen.
- 3755. A section of the integument from the pectoral and axillary region of a *Pteropus*, showing the large and compressed subpedunculate nipple.
- 3755 A. A young Ring-tailed Macauco (*Lemur Catta*, LINN.), showing two small nipples on each side of the pectoral region.

*Presented by H. B. Chalon, Esq.*

- 3755 B. Two sections of the pectoral integument of a young female Orang Utan (*Simia Satyrus*, LINN.), showing the single nipple on each side,

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\* On the Anatomy of the Breast, 4to, 1840, pl. iv. fig. 3 and 4.

and, below the one on the left side, a smaller abnormal nipple, in the apex of which a small bristle is inserted: the form of the normal nipple is a depressed cone, having the apex perforated by ten or twelve lactiferous ducts, and with a circle of sebaceous glands around its base.

*Presented by the Zoological Society of London.*

3756. A section of the integument of the breast of a young Woman, including the nipple; it shows the orifices of the lactiferous ducts at the obtuse apex of the cone, the wrinkled integument forming the sides of the cone, and the circle of large sebaceous glands surrounding its base.
3757. A section of the integument of the breast, and part of the mammary gland and nipple of a Woman at the period of lactation: the increase of the size of the nipple may be computed by the distance of its apex from the zone of large sebaceous glands, as compared with that in the preceding preparation; the orifices of these glands are very conspicuous at the base, and those of the lactiferous ducts at the apex of the nipple.

## SERIES XIX. Marsupial pouch, mammæ and mammary foetus in the Marsupialia.

3758. The posterior half of the Tapao Tafa\* (*Phascogale penicillata*, TEMM.), with the abdominal fold of integument forming the marsupial pouch artificially dilated to show the nipples; these are eight in number, arranged in a circle; they are elongated, subcompressed, with an obtuse summit, appearing to have been in use at the time when the animal was caught.
3759. An Opossum (*Didelphys Opossum*, LINN.), showing the opposite, lateral, semilunar folds of integument which form the marsupial pouch, with the nipples, of which five were in use when the animal was killed. A young Opossum, far advanced in growth, covered with hair, and with its eyes

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\* The specimen which Hunter has sacrificed for this preparation, is the individual from which were taken the description and figure of the species, under the name of Tapao Tafa, given in the Zoological Appendix to 'White's Journal of a Voyage to New South Wales,' 4to, 1790.

open, adheres to one of the nipples ; these in the present species are seven in number, arranged three on each side and one in the centre of the pouch. From the circumstance of the nipples of the Marsupialia, when not in use, and in the young animal at least, being retracted and concealed in a depression of integument, analogous to a prepuce, two of the nipples are scarcely visible in this preparation ; the orifice of the mammillary prepuce only is obvious in the upper nipple on the right side ; the apex of the central nipple may be observed at the orifice of its prepuce.

3760. A section of the ventral parietes of the abdomen and pelvis of the Virginian Opossum (*Didelphys Virginiana*, SHAW), showing the marsupial pouch and the external aperture of the cloaca.

3761. A young Opossum, in the condition of a mammary fœtus, naked, and with the eyelids closed by a continuation of cuticle over their commissure : the abdominal pouch is indicated by a crescentic fold of integument, not sufficiently developed to conceal the nipples ; these are arranged in a circle, with the larger one in the centre ; the clitoris, which is of disproportionately large size, may be seen protruding from the cloacal outlet ; the circular and terminal aperture of the mouth, characteristic of the mammary fœtus of the Marsupialia, is well shown in this preparation.

3761 A. A female Pigmy Flying Opossum, or Petaurist (*Petaurus pigmæus*, CUV.), which had two mammary fœtuses in her pouch when killed : one of these is displayed *in situ*, as also the long, slender nipple to which the other was attached. *Presented by George Bennett, Esq., F.L.S.*

3761 B. The mammary fœtus of the Pigmy Petaurist, removed from the preceding preparation : the ventral parietes of the abdomen are dissected and reflected principally to show the trace of the urachus or pedicle of the allantois, continued from the apex of the urinary bladder to the umbilical cicatrix. *Prepared by Mr. Owen, from the specimen presented by George Bennett, Esq., F.L.S.*

3762. A female mammary fœtus of a Petaurist, showing the situation of the



abdominal pouch ; the clitoris, which projects from the cloacal aperture, is almost as large as the penis in the male.

3763. A young male Petaurist: the mouth has assumed its natural form ; the eyelids are open ; the cuticle, and probably the hair, have been removed from this specimen ; the fold of skin between the fore- and hind-leg on each side, which constitutes the parachute characteristic of this Marsupial genus, is here displayed ; the testes have descended into the pedunculate scrotum, the peculiar position of which, analogous to that of the pouch of the female, and anterior to the penis, is well displayed in this specimen.

3764. The mammary foetus of the Vulpine Opossum (*Phalangista Vulpina*, Cuv.), apparently at a short period after birth ; it is little more than half an inch in length : the situation of the eyes is scarcely discernible ; the ears are indicated by small projections ; a fine white line, like a cicatrix, indicates the 'rictus oris,' which is open only at the extremity of the mouth ; the end of the tongue, which is bent with its concavity towards the roof of the mouth for the firm embrace of the nipple, may be seen close to the subcircular, terminal, oval aperture ; the parietes of the abdomen have been reflected to show the continuation of the urachus from the urinary bladder to the umbilical cicatrix.

3765. A young female Phalanger (*Phalangista gliriformis*, BELL), showing the position and form of the rudimental pouch.

3765 A. A section of the integument, with the posterior part of the marsupial pouch of a Kangaroo (*Macropus major*, LINN.), including the four nipples and the mammary glands : the nipples are all everted or protruded from their preputial sheaths, but, together with the glands, are of small size ; the muscle which invests the mammary gland\*, and, by means of that body, is attached to the posterior part of the pouch, has been dissected from one of the glands, but its remains may be observed upon the other.

*Presented by Sir Everard Home, Bart.*

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\* The student is referred for descriptions and illustrations of the structure and mechanism of the mammary gland in the Kangaroo, to Mr. Morgan's excellent Papers in the Linnean Transactions, vol. xvi.

3766. A section of the posterior part of the integument forming the marsupial pouch and mammary gland of a Kangaroo (*Macropus major*, LINN.): the lower nipple of the left side had been in use at the time when the animal was killed, and, from its great length and size, the mammary fœtus must have been pretty far advanced; the other nipples are not larger than those in the previous preparation; the posterior part of the secreting mammary gland is dissected, and its lobulated structure is shown.
3767. The upper and lower nipple of a Kangaroo, which was suckling a mammary fœtus with the lower nipple; the uninjected lacteal ducts are displayed in their course through the lower nipple, at the extremity of which their terminal orifices may be seen.
- 3767 A. A female mammary fœtus of a Kangaroo, which was born in Exeter Change. This fœtus, which was conjectured to have been six weeks in the pouch, measures two inches two lines in length: it shows the aperture of the pouch, the large protruded clitoris, the closed commissure of the eyelids, and the confluence of the lateral parts of the opening of the mouth, at the round terminal aperture of which may be seen the apex of the tongue: the nearly equal size of the fore and hind extremities at this period of growth likewise merits notice in this preparation.
- Presented by Mr. Cross.*
3768. A male mammary fœtus of the Kangaroo, exhibiting the position of the pedunculate scrotum: the right side of the mouth has been removed to show the extent to which the nipple is received into that cavity, and how firmly it is grasped between the tongue and palate.
3769. A female mammary fœtus of the Kangaroo, from which the right half of the head has been dissected, showing the depression on the dorsum of the tongue for the reception of the nipple, and the pyramidal form and great development of the epiglottis, which passes into the circular posterior aperture of the nares, and thus defends the trachea from the entry of the milk which may be injected down the fauces of the fœtus by the mammary constrictor muscle of the parent: this structure is analogous to the mechanism of the larynx in the Cetacea, by which the aperture of the windpipe in them is similarly defended from the water which may

enter the mouth: a bristle is passed along the right nasal meatus into the larynx.

3770. A section of the lower jaw and tongue, with the soft palate and larynx of a mammary fœtus of the Kangaroo; the parts are attached to the extremity of the nipple of the parent, showing the mode in which the nipple is grasped by the tongue, and the relative position of the larynx to the tongue and soft palate at the posterior aperture of the mouth.
3771. A mammary fœtus of a Kangaroo, from which the right half of the head and the parietes of the abdomen have been removed: the large urinary bladder is reflected forwards, showing its smooth fundus: a bristle is passed through the nasal meatus and comes out by the side of the larynx, which is in its natural position, grasped by the muscles of the soft palate; the nipple of the parent is left in the mouth of the fœtus, lodged in the groove on the dorsum of the tongue.
3772. A male mammary fœtus of the Kangaroo: the hind legs are now beginning to acquire their disproportionate size.
3773. A female mammary fœtus of the Kangaroo, farther advanced in growth.
3774. A male mammary fœtus of the Kangaroo, still more advanced in growth.
3775. A female mammary fœtus of the Kangaroo, in which the hind legs and the tail have nearly acquired their normal proportions.
3776. A male mammary fœtus of a Kangaroo: the lateral parts of the 'rictus oris' are now open, as is also the commissure of the eyelids; the whole embryo from the nose to the extremity of the tail measures twelve inches, but as yet there is no trace of hair upon any part of the integument.
3777. A female Opossum (*Didelphys dorsigera*, LINN.), with two of her young, showing the mode in which they are transported from place to place by the mother, adhering to the fur of her back by means of their claws, and entwining their tails around hers. In this, as in many other of the smaller species of Opossum, the marsupial folds of the abdominal integument are so shallow as not to conceal the nipples, nor to afford the parent the means of transporting her young in the mode which is peculiar to the rest of the Order: it may be observed, however, that the marsupial bones



are nevertheless relatively as well developed in these as in those species which possess a true nidamental pouch, the marsupial bones being physiologically related to the function of the mammary glands in the female, and to that of the testes in the male, rather than to the support of the pouch.

## SERIES XX. Nidamental Structures.

[Natural or artificial cavities for the incubation or protection of the young.]

3778. A Toad (*Bufo dorsiger*, LINN.), with one of its young, which are transported by the parent, clinging to her back, like the young of the dorsi-gerous Opossum.
3779. A female Surinam Toad (*Pipa monstrosa*, LAUR.), showing the tegumentary cells on the back in which the young are protected and transported by the parent during the whole period of their metamorphosis.
3780. A similar specimen, exhibiting the dorsal cells at their period of functional activity: many of the young are here seen in the act of extricating themselves from the cells, their metamorphosis having been completed; others, which have escaped, lie at the bottom of the bottle: the cells which still retain the larvæ have their mouths covered over with a thin transparent layer of cuticle.
3781. The right half of a vertically bisected Surinam Toad, with some of her young brood in the dorsal cells, the structure and relations of which to the skin are well displayed by this section: the skin is separated from the subjacent muscles by a wide lymphatic sinus or interspace; this latter condition of the absorbent system is common in the Batrachia.
3782. A Craw-fish (*Astacus fluviatilis*, FABR.), showing the marsupial subcaudal cavity in which the ova are protected during the process of development; they are appended by short pedicles to ciliated articular processes, which are attached to the under surface of the segments which form the nidamental cavity.
3783. A Craw-fish, showing the remains of the incubated ova, and some of the

newly excluded young attached to the ciliary nidamental processes of the subcaudal plates.

3784. A female Crab (*Cancer*, LINN.), showing the mass of ova supported and protected between the tail and the sternal plate or plastron.

3784 A. A female Crab (*Xantho*, LEACH), exhibiting the ova protected and supported by the broad segments of the tail and their ciliated appendages.

*Presented by Frederick Bennett, Esq., M.R.C.S.*

3784 B. A male Crab of the same species, to show the sexual difference in the development of the caudal segments in consequence of their not being destined to perform the marsupial function in this sex.

*Presented by Frederick Bennett, Esq., M.R.C.S.*

3785. A male Pipe-fish (*Syngnathus Typhle*, LINN.), with the ventral parietes of the abdomen and of one of the subcaudal marsupial pouches removed, showing in the abdomen the simple tubular testes much diminished in size after the completion of their function, and in the marsupial pouch the ova which they have served to impregnate.

3786. A male Pipe-fish of the same species, with both divisions of the subcaudal marsupial pouch removed: some young Syngnathi still remain near the anterior extremity of the pouch, but the rest have been excluded.

3787. A male Hippocampus, with the left parietes of the abdomen and sub-abdominal marsupial pouch removed, and a numerous brood of half developed young Hippocampi displaced.

3787 A. A leaf of a Lime-tree, from the upper surface of which there have been developed, through the irritation produced by the ova of a Lepidopterous insect, deposited in the cellular tissue, nests or galls, which serve to protect such ova during their development.

*Presented by Sir Everard Home, Bart.*

3787 B. A cluster of the nidamental capsules of the Whelk (*Buccinum undatum*, LINN.). These chambers, which serve to protect the ova during the development of the young mollusk until it has acquired its own defensive

shell, are formed by the secretion of a peculiar gland, situated near the termination of the oviduct of the parent.

*Presented by William Clift, Esq., F.R.S.*

3787 c. The nest of the Java Swallow (*Hirundo esculenta*): it was termed 'a male's nest' by the donor, *Sir Stamford Raffles, Pr. Z.S.*

3787 d. A similar but somewhat larger specimen of the edible nest of a Java Swallow, termed a female's nest by the donor, *Sir Stamford Raffles, Pr. Z.S.*

3787 e. Three specimens of the nest, and fragments of the nest and the shell of one egg of the Java Swallow. *Presented by Sir Stamford Raffles, Pr. Z.S.*

3787 f. A nest, with the shells of two eggs of a smaller species of Swallow: the substance of which this nest is composed resembles that of the edible nests just described, but it is more artificially disposed in the manufacture of the nest, which consists of fine fibres inextricably interwoven, and with a broad and slightly flattened surface on one side for the attachment of the nest: the present specimen is from a subterraneous cave in Sanay, one of the Philippine islands, which is frequented by vast numbers of this species of Swallow for the purpose of nidification.

*Presented by Hugh Cuming, Esq., Corr. Z.S.*

3788. A Wagtail (*Motacilla lugubris*, TEMM.), with her nest and callow brood.

3789. A Nightingale (*Sylvia modularis*, TEMM.), with her nest and callow brood.

3790. The nest and models of the young of a Field-mouse (*Arvicola arvensis*, Cuv.).





Fig. 1.

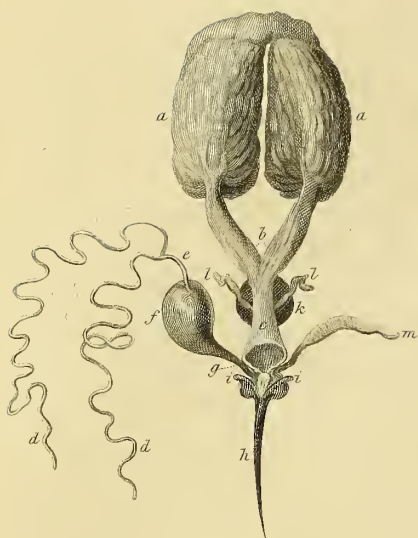


Fig. 3.



Fig. 4.



Fig. 5.



Fig. 2.

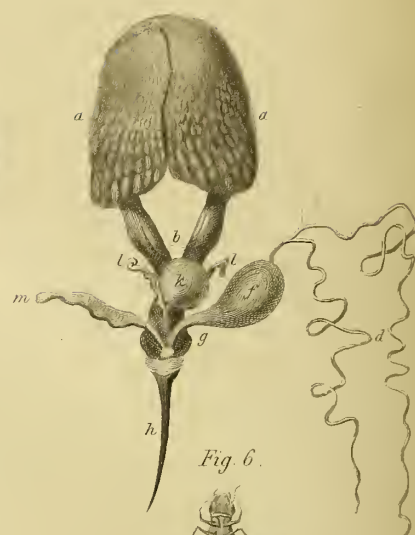


Fig. 6.

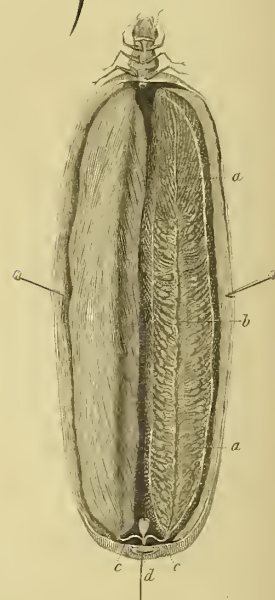


Fig. 9.



Fig. 8.

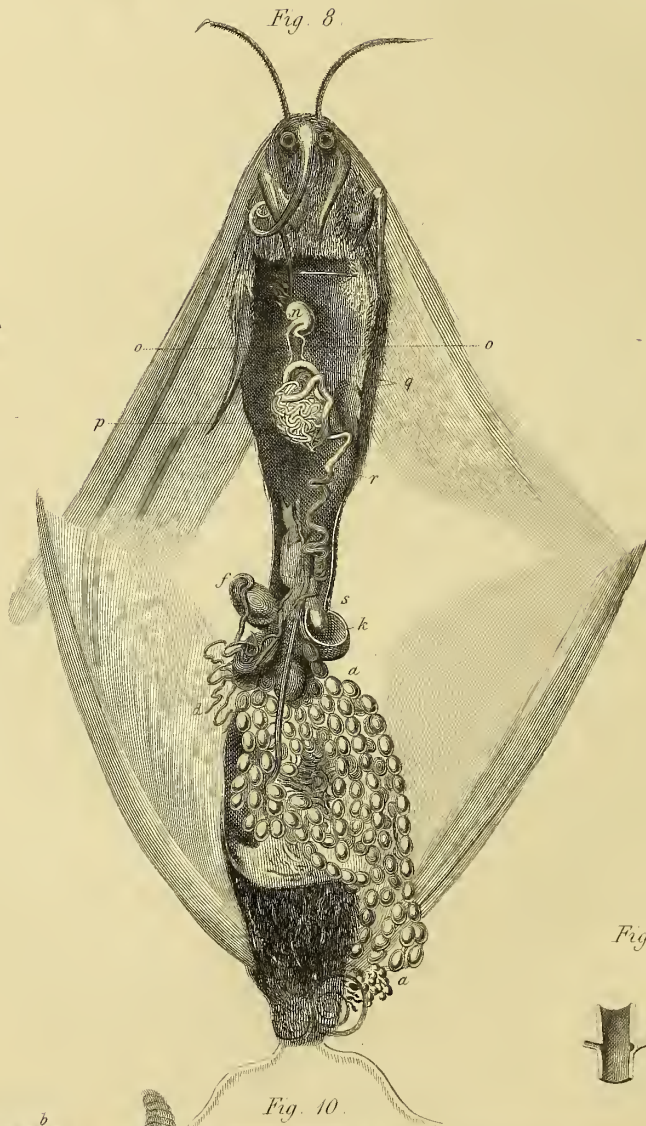
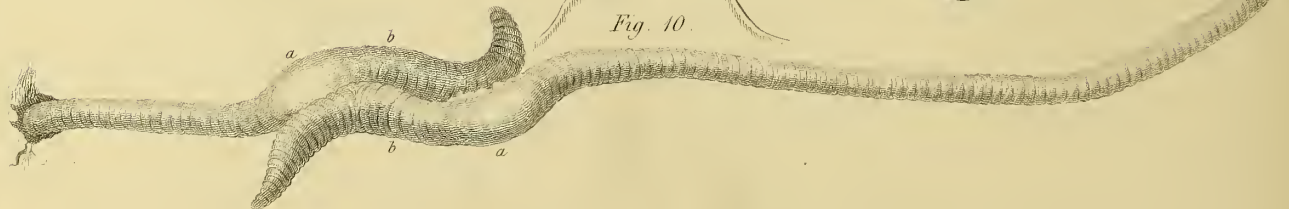


Fig. 7.



Fig. 10.



## DESCRIPTION OF THE PLATES.

## PLATE LXVII.

*Fig. 1.* Female organs of the Queen-bee (*Apis mellifica*, LINN.), viewed from the ventral or inferior aspect, and magnified.

*a, a,* The ovaria, consisting of numerous tubes, which commence by fine capillary cæcal extremities in which the germinal vesicle or essential part of the ovum is formed, and which gradually expand as they approach the oviduct, while the elliptical ova increase in size by addition of vitelline matter. The ovarian tubes, where they are enlarged, put on an interrupted or beaded appearance, and all unite at one point, in each ovarium, to form

*b,* The proper oviducts. These are short, wide, and of a very delicate tissue; they converge in a short unconvoluted course, and unite to form

*c,* The common oviduct, which terminates at the base of the sting, or modified ovipositor, by the vaginal opening.

*d, d,* The secerning tubes of the poison of the sting: traces of their fine capillary commencement appear to have been noticed and figured.

*e,* Their common efferent duct.

*f,* The poison-bladder.

*g,* The poison-duct.

*h,* The sheath of the sting.

*i, i,* The retractor muscles of the sting.

*k,* The spermatheca, or reservoir of the semen received from the male *in coitu*, and kept in store to fecundate the ova, as they successively pass its outlet.

*l, l,* A pair of small secreting tubes, attached to the spermatheca.

*m,* The rectum.

*Fig. 2.* Female organs of the Queen-bee, seen from the upper or dorsal aspect, and magnified.

The same letters indicate the same parts as in the previous figure.



*Fig. 3.* A female Humble-bee (*Bombus terrestris*, LATR.), with the abdomen laid open to show the ovaria *a, a*, and the oviducts *b, b*, *in situ*. The ovaria are four in number on each side, and commence by extremely minute capillary tubes at the thoracic part of the dorsal vessel; they thence pass backwards along the stomach *c*, behind which they dilate into two fusiform masses *a*; the posterior end of each of these bodies is the point of confluence of the four ovarian tubes to form the proper oviduct *b*. The two proper oviducts are relatively longer than in the Hive-bee, and unite to form a short common oviduct, which terminates at the base of the ovipositor or sting.

*f*, Poison-bag.

*h*, Sheath of the sting.

*Fig. 4.* A female Termite, before the ovaria *a, a*, have begun their disproportionate growth.

*Fig. 5.* One of the ovaria, dissected and magnified, showing that it consists of two lateral series of simple pyriform utriculi, communicating with a median duct. It is by the progressive development of new utriculi from the elongating duct, and the elongation and relative attenuation of the utriculi, that the ovarium subsequently attains its enormous bulk.

*a*, A single ovarian utricle, in the unexcited state.

*Fig. 6.* A female or Queen Termite, with the ovaria fully developed. A longitudinal section has been removed from the one on the left side.

*a*, The ovarian tubes, developed from the utriculi.

*b*, The median canal of communication of these tubes.

*c, c*, The proper oviduct.

*d*, A bristle passing through the rectum, which receives the termination of the short common oviduct.

Above the distended abdomen may be seen the three thoracic segments and the head, with their appendages, retaining the ordinary size.

*Fig. 7.* A portion of the median ovarian canal laid open, with a single ovarian tube, and the stem of an opposite one. The ova are arranged in a single series in the tube, progressively increasing in size as they approach the median canal.

*Fig. 8.* The male and female Privet-Moth (*Sphinx Ligustri*, LINN.), killed in

*coitu*; and both dissected, to show the generative organs†. The upper figure is that of the male, which is outwardly distinguished by his more simple antennæ.

*n*, The single testis, produced by a confluence of two originally distinct testes in the larva.

*o, o*, The two vasa efferentia.

*p*, The epididymis, formed by their numerous convolutions.

*q*, The vasa deferentia, which soon unite to form the common vas deferens, *r*.

*s*, The penis. It has entered the spermatheca, *k*, of the female.

*a, a*, The ovarian tubes laden with mature ova.

*d*, The gland of the colleterium.

*f*, The vesicle of the colleterium.

These are two in number, and are described by Hunter as "two long bags or canals, which at their extremities become small at once, and from thence goes out a small duct which divides into several. They appear to unite behind the former (spermatheca), and they open into the oviduct at the union of all these parts. This is filled before copulation with a transparent mucus. I am apt to suspect that the use of this last-described mucus is to give the sticking coat to the egg."—*Hunterian Manuscript*.

*Fig. 9.* The female organs of the Privet-Moth dissected out, and the ovarian tubes cut off.

*a, a*, The terminations of the four ovarian tubes on each side.

*b, b*, The proper oviducts.

*d, d*, The secerning tubes of the colleterium.

*f, f*, The colleterial bladders. (The colleterium is obviously the analogue of the poison-gland and -bladder in the Bee.)

*k*, The spermatheca‡.

*l*, Accessory vesicle of the spermatheca. The two bristles are inserted, one into the rectum, the other into the vulva.

*Fig. 10.* Two Earthworms, *in coitu*.

*a, a*, The enlarged segments or 'clitellum,' which is the chief organ of

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† See Prep. No. 2851.

‡ See Hunter's Experiments on this receptacle, Phys. Catal. vol. iv. p. 115.

mechanical adhesion, and to which are attached, at this season, one or two appendages, that probably serve as organs of excitement.

The generative pores are situated opposite the letters *b, b*; they are brought into simple contact without intromission.

### PLATE LXVIII.

The figures in this Plate exhibit the Evolution of the Embryo of the Bird, from the cicatrix to the appearance of the vertebral nuclei.

*Fig. 1.* The vitellus, or yolk of the egg of the Common Fowl, showing the cicatrix impregnated, but prior to the commencement of incubation. The opaque white centre (*a*) of the cicatrix consists of the primitive albuminous cells or granules of the germinal membrane, separated by a well-defined line from the peripheral series of granules (*b*), which afterwards become expanded into the area opaca seu vasculosa. The tortuous filaments at the poles of the yolk (*c, c*) are the chalazæ, and constitute the chief part of the mechanism by which the side of the yolk supporting the cicatrix is preserved, during incubation, nearest the body of the parent. The whole is included within the transparent membrana vitelli (*Fig. 2. a.*).

*Fig. 1\*.* The cicatrix of the egg of a Goose, before incubation.

*Fig. 2.* The cicatrix of the egg of a Goose (*Anser palustris*, BR.†), six hours after incubation has commenced; magnified and viewed by reflected light on a dark ground.

*a,* The transparent membrana or cuticula vitelli, reflected.

*b,* The substance of the yolk.

*c,* The halones, or peripheral expansion of the blastoderm, or germinal membrane.

*d,* Peripheral stratum of granules, afterwards the 'area opaca,' or 'area vasculosa.'

*e,* The inner circle of the primitive embryonic granules, afterwards the 'area transparenens.'

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† All the subsequent figures in this Plate are of the embryo of the same species of bird, and are figured as seen under the same circumstances and magnifying power.



Fig. 1.

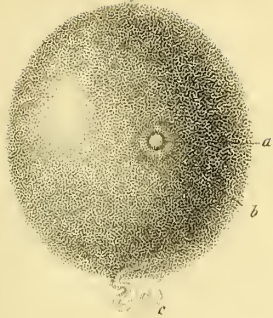


Fig. 2.

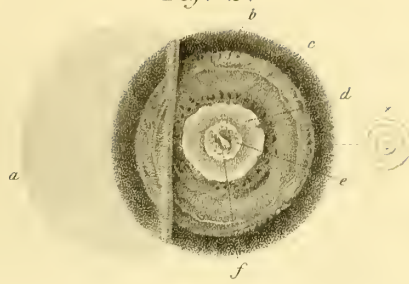


Fig. 3. Pl. LXIII



Fig. 4.

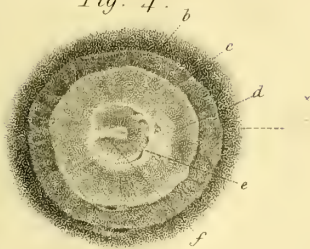


Fig. 5.



Fig. 6.



Fig. 8.

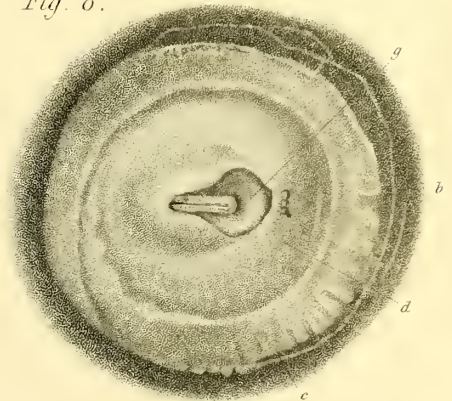


Fig. 7.

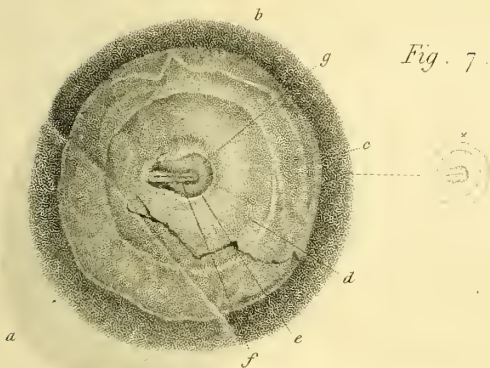


Fig. 9.

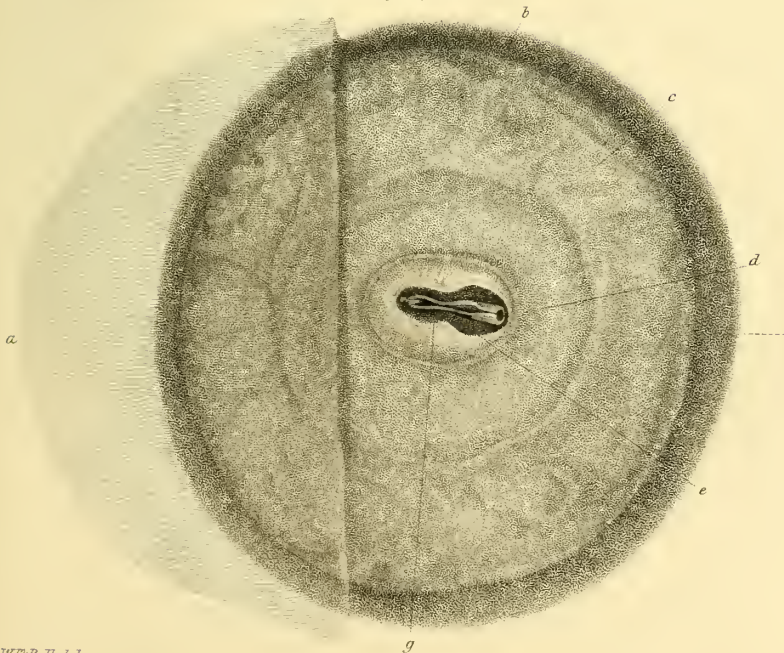
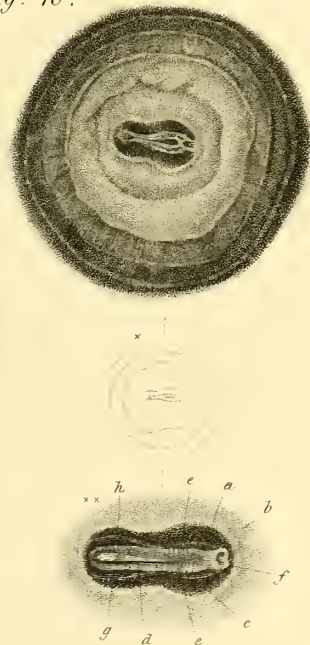


Fig. 10.





*f*, The linear nucleus of the germ, or 'gleba centralis' of Pander.

\* Natural size.

*Fig. 3.* The cicatrix, ten hours after incubation, showing a general cloudiness arising from the diffusion of newly-formed germinal granules, an appearance not unfrequently observed prior to the next well-marked stage of embryonic development.

\* The same cicatrix, of the natural size.

*Fig. 4.* In this figure may be observed the first appearance of the division of the embryonic nucleus *f* into two lateral columns or folds, the line of separation extending as far as the extremity occupying the centre of the cicatrix. These lines in the succeeding figures will be more plainly recognised as the lateral folds, or 'plicæ primitivæ †,' in which are formed the columns of the spinal chord; but it is important here to remember, that the first appearance of the medullary streak is single, as in *f*, *Fig. 2*, and that consequently the development of this fundamental part of the organization has proceeded from the centre to the circumference, or is centrifugal. The letters signify the same parts as in *Fig. 2*.

\* Natural size.

*Fig. 5.* A further increase of the parts shown in the preceding figure.

\* Natural size.

*Fig. 6.* This figure shows apparently some irregularity in the progress of development; the centrifugal course of the opaque granules from the inner circle has now left a clear space around the nucleus, forming the 'area pellucida' of Pander.

\* Natural size.

*Fig. 7.* The cicatrix (18?) hours after incubation. The letters signify the same parts as in *Fig. 2*. The lateral primitive folds of the embryonic streak are now very distinct, and a collection of albuminous granules or cells beneath the area transparens of the blastoderm, and constituting the 'cumulus proligerus' *g*, gives the appearance of the embryo being

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† The plicæ primitivæ seem to be duplicatures of the serous or peripheral layer of the blastoderm, formed by the accumulation beneath of minute albuminous granules or cells, the convexity of the fold being directed towards the shell. These parallel longitudinal plicæ were observed by Malpighi, who termed their interspace the 'spatium carinatum.'



supported on a vesicle, as described by Pander. The characteristic fragile texture of the germinal membrane is beautifully illustrated by the fissure represented in the Hunterian drawing.

\* Natural size.

\*\* The primordial parts of the embryo, area *transparens* and area *opaca* of the germinal membrane, from another ovum, about the same period of incubation, showing more distinctly the outline of the cumulus *proli-gerus*.

*Fig.* 8. Shows a further stage of development, in which the albuminous matter of the medullary chords begins to be concentrated near the mesial margins of the primitive longitudinal embryonic folds.

*Fig.* 9. A portion of the yolk, with the germinal membrane from which the *membrana vitelli a* is partially reflected.

The pellucid area *e*, with its contained embryo, is very distinctly shown, the central cells or granules having disappeared. The *plicæ primitivæ* have begun to dilate towards the cephalic extremity, to form the cavities in which the brain is to be developed.

*g*, The halo, or line which marks the central limits of the vascular area: some of the canals in which the colourless nutrient fluid circulates are now apparently faintly visible in this space.

*Fig.* 10. The germinal membrane and embryo, at a further stage of development, between the 24th and 30th hours of incubation.

\* Natural size.

\*\* The area *pellucida*, and embryo of the same ovum, more highly magnified.

*a*, Central boundary of

*b*, a portion of the vascular or opaque area.

*c*, The pellucid area.

*d*, The spinal chord.

*e*, Cartilaginous nuclei of the superior arches or *neurapophyses* of the *vertebræ*.

*f*, Cerebral cells or dilatations of the primitive dorsal folds.

*g*, Posterior folds of the germinal membrane, which subsequently form the 'involucrum caudæ.'

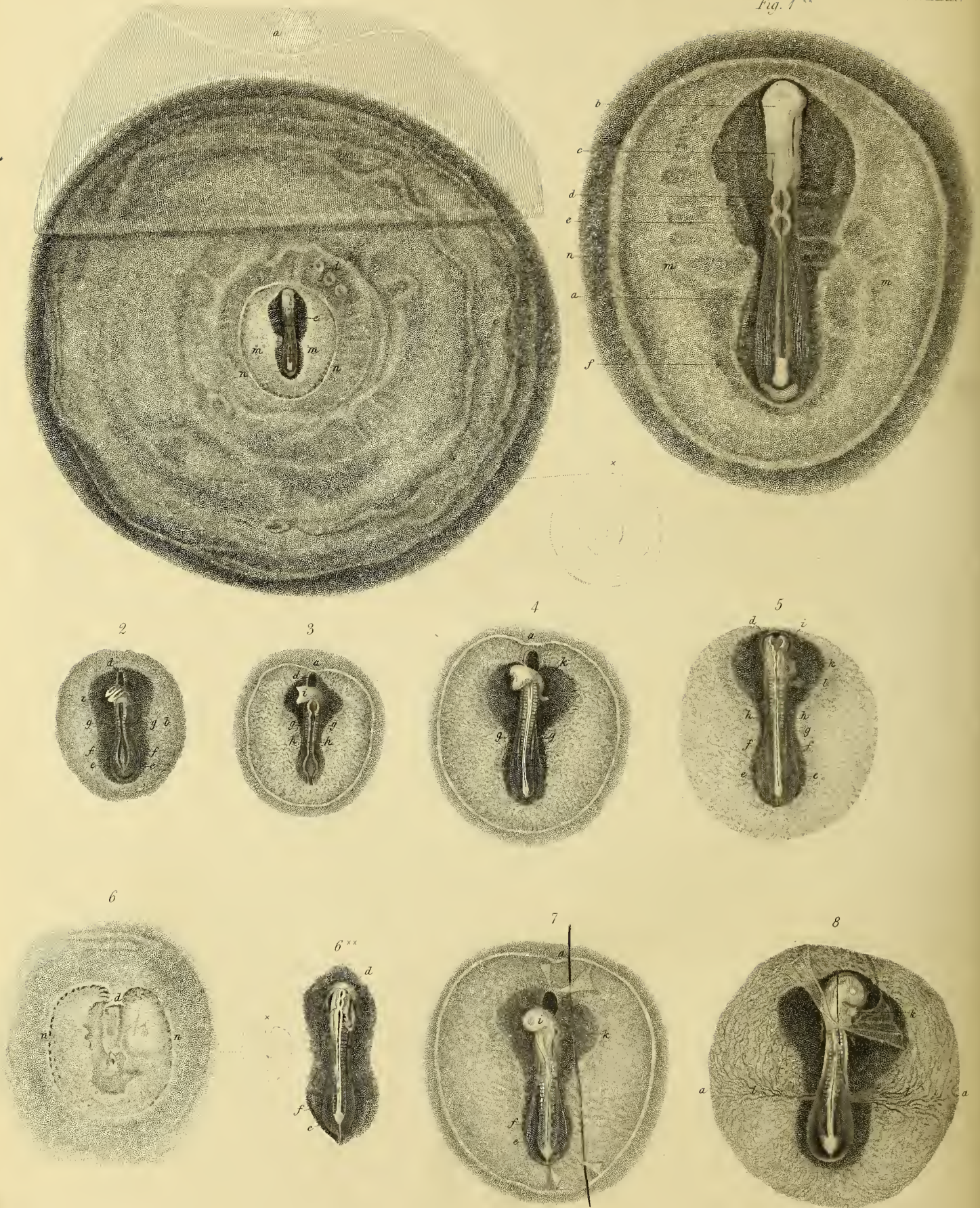
*h*, Rudiments of the mesenteric or abdominal folds.





Fig 1.

Fig. 1<sup>xx</sup>





## PLATE LXIX.

The first two figures in this Plate exhibit the condition of the embryo at the commencement of the formation of the blood-lakes in the vascular area: the period of development being intermediate to that displayed in Figures 9 and 10 of the preceding Plate, but the parts more highly magnified.

*Figs. 2 to 8.* Illustrate the earlier stages of the development of the central axis of the nervous system and its protecting osseous case, and also the first steps in the formation of the cutaneous and amniotic envelopes of the embryo. Except in Figure 6, the objects are magnified in the same degree, and are represented as viewed by reflected light and placed on a dark ground.

*Fig. 1.* The germinal membrane and embryo exposed on the surface of the yolk *b*, by the reflection of its proper tunic, or membrana vitelli *a*. The halones, or peripheral waves of the germinal membrane *c* are spreading over the surface of the yolk, and laying the foundation of the future vitellicle. *d*, Partial accumulations of albuminous cells inclosing a fluid centre in the halones.

*e*, Area transparens.

*m*, Area vasculosa, at the periphery of which

*n*, The blood-lakes are beginning to appear.

\* The natural size.

*Fig. 1\*\*.* The same embryo, with the area transparens and area opaca, further magnified.

*a*, Fold of the serous layer of the blastoderm, marking out the lateral parietes of the abdominal cavity.

*b*, Cephalic dilatation of the cerebral cell formed by the plicæ primitivæ, and in which the olfactory lobes or cerebral hemispheres are subsequently developed.

*c*, The portion of the cerebral cell or dilatation wherein the foundation of the optic thalami is laid.

*d*, The dilatation of the cerebral cell, in which the optic lobes or corpora bigemina are developed.

*e*, The posterior dilatation for the medulla oblongata. From this the lateral columns of the spinal chord are continued, which terminate in an opaque group of granules or cells *f*, which form the foundation of the future pelvis. The termination of the surrounding fold of the serous layer of the germinal membrane is called the 'involucrum caudæ.'

*m*, The opaque, afterwards the vascular, area.

*n*, Its peripheral boundary.

*Fig. 2.* This figure exhibits the stage of development next succeeding that of Figure 10, Plate LXVIII.

*b*, The opaque area.

*c*, The transparent area.

*d*, The depression in the transparent area formed by the centripetal inflection of the olfactory or cerebral extremities of the cephalic division of the primitive embryonic or nervous columns. These have been turned upwards and bent back, to show their divergence, and the fossa of the blastoderm in which they were lodged.

*e, e*, Parietal folds of the serous layer of the blastoderm.

*f, f*, Mesenteric folds.

*g, g*, Vertebral or neurapophysial cartilaginous nuclei.

*Fig. 3.* The embryo similarly prepared; the ventral surface of the cephalic extremity of the germ (*i*) (which is towards the spectator, from its being turned back out of its fossula) is now occupied by the first trace of the heart, or 'punctum saliens,' and the nervous chords are consequently obscured by it. The notch between the olfactory extremities of these chords is very apparent: the cell of the medulla oblongata is seen immediately below the angle of inflexion.

*d*, The cephalic fossa.

*g, g*, The columns of the spinal chord.

*h, h*, The vertebral nuclei.

*Fig. 4.* The embryo further advanced and similarly prepared. The vertebral nuclei are more numerous and distinct. The lateral columns of the spinal marrow have come into lateral approximation. The caudal extremity begins to push outward the serous coat of the blastoderm, and to

form therewith a sheath or 'involucrum,' analogous to that investing the head.

*k*, The heart, or 'punctum saliens,' now projects on the right side of the cephalic extremity, and one of the vessels in the crura of the transverse cardiae fold is apparent. The cephalic extremity is turned back, as in the two previous figures; the fissure at the anterior part of the cell of the cerebral hemispheres is still unclosed.

*Fig. 5.* The embryo still further advanced. The head is resting in its fossa, so that the whole tract of the medullary chords *h, h*, is distinctly visible. The four dilatations or cells of the cephalic extremity are now clearly developed: the first or lowest of these dilatations is the rudiment of the medulla oblongata; the second, whose contour is more decidedly oval, represents the corpora quadrigemina; the third, the crura cerebri and optic thalami; the fourth and largest, the cerebral hemispheres. It must here be observed, that all these parts are dilatations of one continuous cavity, and that the lateral opaque lines result from the angle of the duplicature of the primitive folds of the serous layer of the germinal membrane constituting the cerebral and spinal cells, and to the coagulation of the medullary matter which adheres in a thin layer to the membrane; while the intermediate space, being filled with fluid, allows the dark ground to be seen through it. The medullary chords appear blended with the opaque dilated mass of albuminous granules at the caudal extremity, from which the pelvis is afterwards to be developed. The vertebral nuclei *g*, are more distinct and numerous than in the previous figures, and on either side of the lower ones may be observed two opaque longitudinal lines resulting from duplicatures of the mucous and vascular layers of the blastoderm, which duplicatures (*f, f'*) afterwards form the mesentery, and cover the rudiments of the primordial kidneys. External to the mesenteric folds are two other slightly opaque lines *e, e*, formed by duplicatures of the whole of the blastoderm, projecting inwards towards the yolk; they appear to form a delicate vesicular envelope to the caudal extremity of the foetus; but their margins, which project towards the yolk, are not closed in front, but constitute, first, the rudimentary parietes of the intestinal canal, to which the mu-



cous and vascular layers contribute, and secondly, the parietes of the abdominal cavity, which the serous layer defines: hence they are here termed the 'plicæ parietales' or parietal folds, *e, e*. The heart *k*, projecting in the form of a semicircular canal to the right side of the body, seems to receive a vessel forming a fold *l*, in the same situation as that in the preceding figure. The margins of the cephalic fossa *d*, lined by the serous layer of the blastoderm, are distinctly shown. The margins of the opaque area seem encroaching upon the pellucid area opposite the middle of the embryo; no distinct vessels can yet be seen in the vascular layer, but there are plain indications of the canals through which the now pale-coloured blood is moving†.

*Fig. 6.* The embryo and a portion of the surrounding germinal membrane, magnified a little more than two diameters, showing the true position of the small specks of blood at the periphery of the opaque area *n, n*.

These are more distinct than in *Fig. 1*, and are now approximating to constitute the terminal sinus of the vascular area.

\* Natural size.

\*\* The embryo placed upon a dark ground and further magnified. The cephalic extremity is sunk into the depression in the yolk, and is now partly covered by the transverse fold of the serous layer of the germinal membrane continued from the anterior part of the depression *d*, and constituting the first stage in the formation of the amnios.

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† This is the first of the three figures engraved and published in the 'Treatise on the Blood and Inflammation' 4to, 1794, (Plate I.), where it is thus described:

"*Fig. 1.* In this figure the only parts that are distinctly formed are two blood-vessels; on each side of these is a row of small dots or specks of coagulated blood, which are afterwards to become blood-vessels."—p. 567.

The parts here alluded to are the two columns of the spinal chord *h, h*, and the rudiments of the vertebræ, *g*. As Hunter left no detailed description of his drawings of the embryo of the chick, the editor of his posthumous work supplied the descriptions of the figures introduced into that work; prefacing the descriptions by the statement that "The preparations from which these figures are taken form part of a complete series, contained in Mr. Hunter's collection of comparative anatomy," p. 567. A perusal of the general account of the development of the Bird, published in the Introduction to the present volume, and an inspection of the consecutive series of figures engraved from Hunterian drawings to illustrate the same volume, must exonerate Hunter from any participation in the mistaken account of one of these figures just quoted, especially when it is seen to be described as 'a representation of the earliest visible appearance of distinct organization.'—R. O.

*Fig. 7.* In this figure the cephalic extremity, *i*, is turned back out of the primitive amniotic fossa. The cerebral cells of the plicæ primitivæ are now distended with medullary matter and brought into approximation.

The chief interest in this figure is the clear and unequivocal manner in which Hunter, by his artist William Bell, demonstrates the serous layer of the blastoderm, which is reflected from the vascular layer opposite the two extremities of the embryo, and a fine hair is represented as passing between these two layers.

The mesenteric (*f*) and parietal (*e*) plicæ of the blastoderm make it appear as if the embryo were enveloped in a double vesicle. The heart or punctum saliens (*k*), projecting on the right side of the embryo, is more distinctly defined. One of the primitive venous canals leading to it along the cardiac fold appears to terminate abruptly, and a longitudinal vessel seems leading down from it parallel with the spinal chord; this vessel seems lost in the right mesenteric or renal fold. The striæ in the vascular layer, which converge towards the embryo, now show a more decided vascular character. The margin of the pellucid area is becoming less defined.

*Fig. 8.* This figure exhibits a further stage of development. The transverse fold of the serous layer of the germinal membrane (*d*, *Fig. 6.*) has extended so far in its progress towards the tail as to cover the foveola in which the cephalic extremity of the embryo is lodged. This part of the amnios has been longitudinally divided and turned back, so as to expose the cephalic extremity and its cutaneous sheath, in which a fine hair is represented passing beneath the fold of the serous layer reflected from its margins to form the amnios.

The head of the embryo is now turned to the right side; the rudiment of the eye is conspicuous; the heart, or punctum saliens, *k*, is seen in profile, and is now divided into three compartments, of which the most inferior is the auricle, the next in succession the now single ventricle, and the third, which in this figure is most defined, is the bulb of the aortæ, which are seen to be two in number. Vessels are distinctly defined in the vascular layer converging towards the umbilical region of the embryo, and afterwards constituting the transverse vitelline veins.

## PLATE LXX.

The figures in this Plate represent principally the earliest stages in the development of the vascular system, and the completion of the amniotic bag.

*Fig. 1.* This is the celebrated figure introduced into the 'Treatise on the Blood' (Plate I. fig. 2.) to illustrate the position "that the blood is formed before the vessels," and "that when new vessels are produced in a part they are not always elongations from the original ones, but vessels newly formed, which afterwards open a communication with the original."

It shows that the now red blood (which made its first appearance in fig. 6, Pl. LXIX. at the circumference of the vascular area,) has found its way into the vitelline or omphalo-mesenteric veins and heart. But as colourless blood circulates in these channels before the red particles are formed, which principally render the canals visible, the force of the conclusion drawn from this appearance is much invalidated.

In this figure the situation of the circular sinus is occupied by small lakes of blood, not confined in vessels, but inclosed between the serous and mucous layers of the germinal membrane, in channels which the primitive nucleated cells are beginning to circumscribe, by forming around them a kind of reticulate or tessellated wall. Similar, but more cylindrical canals, are already forming in the intervals of the serous and mucous layers, and are converging towards the umbilical region of the embryo to constitute the transverse omphalo-mesenteric veins. Red blood having thus reached the heart, which before had circulated lymph or plasma and colourless globules only, it is distinctly seen in the form of a curved canal on the right side of the embryo, below the cephalic dilatation. The zone of the opaque area and the terminal sinus have begun to bend inwards towards the cephalic extremity of the embryo, but the longitudinal veins are not yet manifest.

The parts being figured as they are seen in the yolk, the vertebral nuclei are not visible. In order to see them, it requires that the germ-disc and embryo be placed on a dark ground, as at *Fig. 1\*\**, when the



Fig. 1.



Fig. 2.

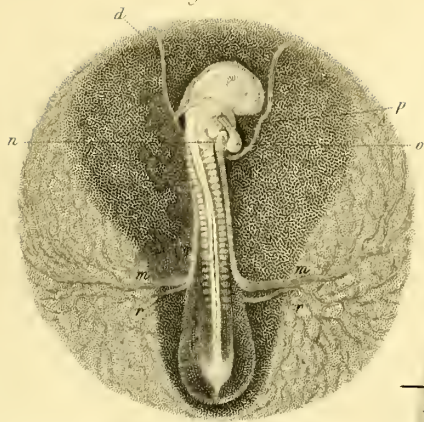


Fig. 5.

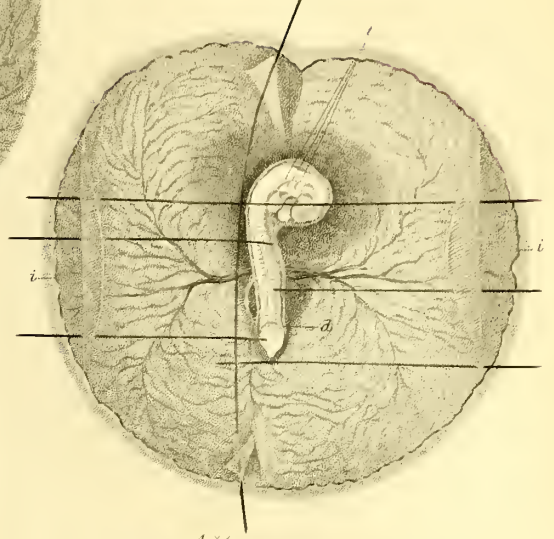


Fig. 1.

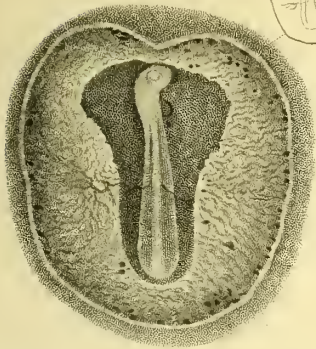


Fig. 2.

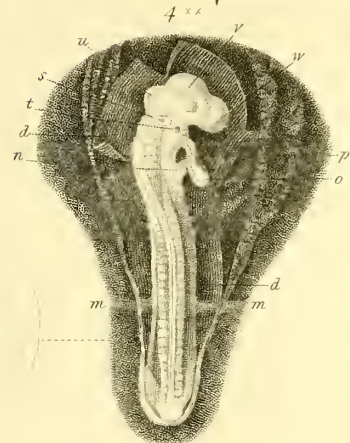
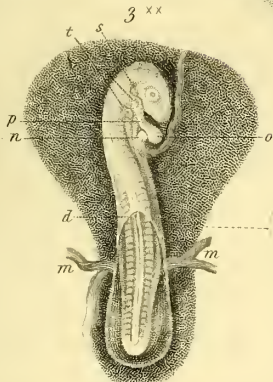
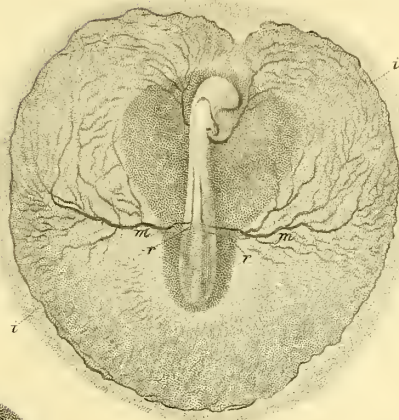
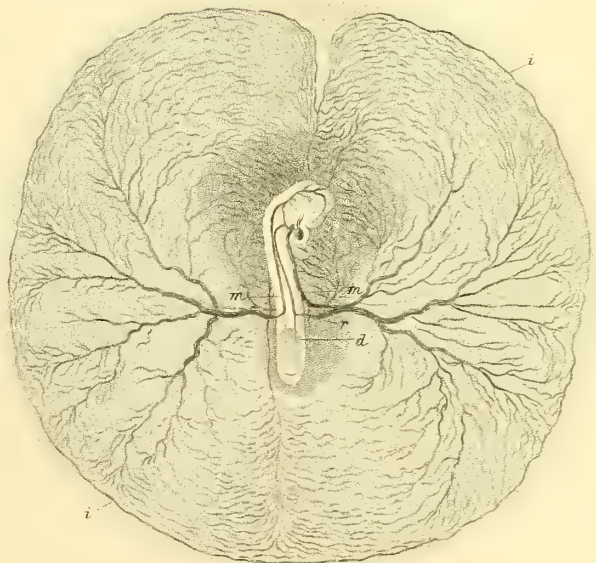


Fig. 3.



Fig. 4.





appearance of the blood and blood-vessels is almost lost. In this figure the membrana vitelli *a*, is reflected from the embryo.

*d*, The amniotic depression.

*e*, Parietal abdominal folds.

*f*, Mesenteric folds.

*g*, Vertebral nuclei.

*h*, Spinal chord.

*Fig. 2.* This forms the third figure in Plate I. of the 'Treatise on the Blood,' in which, however, the engraving does little justice to the beauty of the original drawing.

The circulation of red blood between the embryo and the vascular layer of the germ-disc is now established in distinct vessels, the details of which may be understood by reference to the description of figure 3 of the present Plate.

The zonular sinus *i, i*, is completely formed. The transverse vitelline veins *m, m*, are very distinct; the vitelline or omphalo-mesenteric arteries *r, r*, are more obscure. The two superior longitudinal veins, bringing the blood from the upper part of the zonular sinus, are now clearly developed.

\* Outline of the embryo and germ-disc, natural size.

*Fig. 2\*\*.* The same embryo with the area transparens, placed on a black ground, and more highly magnified. It shows the two transverse (*m, m*) and the two superior longitudinal veins: the ascending trunk of the right transverse vein may be traced to the auricle *n*.

*o*, The ventricle.

*p*, The aortæ. The progress of the amniotic sac *d*, is nearly the same as that shown in fig. 8, Pl. LXIX.

*Fig. 3\*.* Outline of the embryo and germinal membrane, natural size.

*Fig. 3.* The same magnified, as seen on the yolk.

*i, i*, The zonular or terminal sinus.

*k*, The left superior longitudinal vitelline vein.

*l*, The inferior longitudinal vein, bringing blood from the corresponding part of the zonular sinus, and emptying it into the left transverse vein. The



ascending trunk of that vein is seen across the transparent embryo, together with the corresponding trunk of the opposite vein. At their point of junction may be seen the right superior cava returning the blood from the head.

*m, m*, The transverse vitelline veins.

*n*, The auricle.

*o*, The ventricle.

*p*, The aorta; its division is more plainly seen in *Fig. 3\*\**.

*q*, Its descending trunk, formed by the union of the lateral or branchial arches.

*r, r*, Its transverse branches, corresponding to the transverse veins, but much fainter.

The pellucid area is now almost obliterated by the subjacent chyle-like yolk.

*Fig. 3\*\**. The same embryo and area transparens more highly magnified on a black ground. The amniotic sheath *d*, has now extended half-way down the embryo. The vertebral nuclei are distinct to the extremity of the spinal chord. The two transverse veins *m*, the superior longitudinal vein, the auricle *n*, the ventricle *o*, the bulb and double aorta *p*, the auditory meatus *s*, and the branchial folds or fissures *t*, with the eyeball, are all manifest in this figure.

*Fig. 4*. The embryo and vascular area of the germinal membrane at a further stage of development, as seen on the yolk, magnified. The superior cava is more distinct. The division of the aorta is more complete. The degree of inflection of the head is greater. The amnion *d*, is extended over a greater portion of the embryo. *m*, The transverse vitelline veins. *r*, The vitelline arteries, as in the previous figure.

\* Outline of the same, natural size.

*Fig. 4\*\**. The same embryo further magnified, on a black ground. The amniotic sheath *d*, is laid open, so as to bring distinctly into view the contained parts.

*u*, The medulla oblongata.

*v*, The optic lobes, or corpora quadrigemina.

*w*, The cerebrum. The eyeball is below the optic lobe.

*s*, The auditory vesicle and meatus.

*t*, One of the branchial folds.

*n*, The auricle.

*o*, The ventricle.

*p*, The bulb of the double aorta. The trunks of the transverse veins are seen at *m*. The white mass at the end of the spinal chord is the rudiment of the pelvis.

*Fig. 5.* The embryo and germinal membrane at a more advanced stage, seen as resting upon the yolk, but less magnified. The organization of the vascular layer of the germ-disc being now complete, Hunter again demonstrates the serous layer by the interposition of fine hairs between it and the vascular layer of the blastoderm. The embryo is more bent to the right side. The branchial fissures are shown at *t*. The amniotic sheath *d*, has extended to near the caudal extremity of the embryo. It is pierced at several parts by the hairs inserted between the serous and vascular layers. The transverse veins leading from the circular sinus to the umbilical region of the embryo are seen to be more distinct from their corresponding arteries than in the previous figure. The two longitudinal veins, one coming from that point of the circular sinus that bends in towards the head, the other ascending from the opposite part of the sinus and joining the left lateral vein, are less clearly shown. The heart is distinctly seen lying in the concavity of the curve of the cephalic extremity of the embryo.

The pellucid area is now dwindling to a longitudinal space, filled by the embryo: its original limits are still apparent, but the transparency is destroyed by the encroachment of the yolk, now becoming white and milky and more liquid, where it is in contact with the mucous layer of the germinal membrane.

Note that all the figures in Pl. LXX. represent the dorsal aspect of the embryo and the serous surface of the germ-membrane, the pellucid yolk-membrane having been removed.

## PLATE LXXI.

The beautiful drawing here engraved is a continuation of the series exhibiting the progressive development of the vascular system of the embryo, and of the vascular layer of the germinal membrane, now spreading over the yolk to constitute the vitellicle. The beginning of the allantois *f* is also here shown.

The membrana or cuticula vitelli *a*, which is now reduced to extreme tenuity, is reflected from the embryo and germ-disc. The serous layer of the blastoderm, or 'false amnion' of Pander, is also reflected at *b* from the embryo, and its true amnion *c*, which is now completed. The allantois is protruded between the serous and vascular layers. A portion of the combined vascular and mucous layers of the germinal membrane, opposite *d*, is reflected from the substance of the yolk *e*. The rudiments of the wing and leg \*\*, appear now as soft, undivided laminae. The heart, the eye, the ear, and the encephalic masses, may be readily distinguished by a comparison with the preceding figures.

This Plate exhibits a stage of development corresponding with that of the chick at the end of the third day.

## PLATE LXXII.

In the two figures in this Plate, the investment or inclusion of the yolk by the vascular layer of the germinal membrane is seen to be nearly completed.

In *Fig. 1*, the embryo is represented in its natural position, resting upon the yolk; the pellucid area has become very indistinct; the development of the allantois *o*, is further advanced; the parts are less highly magnified than in Plate LXXI.

*a, a*, The longitudinal vitelline veins.

*b*, Ascending trunk of one of the transverse vitelline veins.

*c, c*, The inferior vena cava.

*d*, One of the aortic arches.

*e*, Right superior vena cava.

*Fig. 2*. The embryo of the Goose at a more advanced stage of development, with the vitellus, and germinal membrane or vitellicle. The close-fitting amnios *n*, has been laid open and reflected from the embryo upon the short and thick umbilical pedicle and the vitellicle. The anterior parietes of the thorax have also been removed.





a.











a

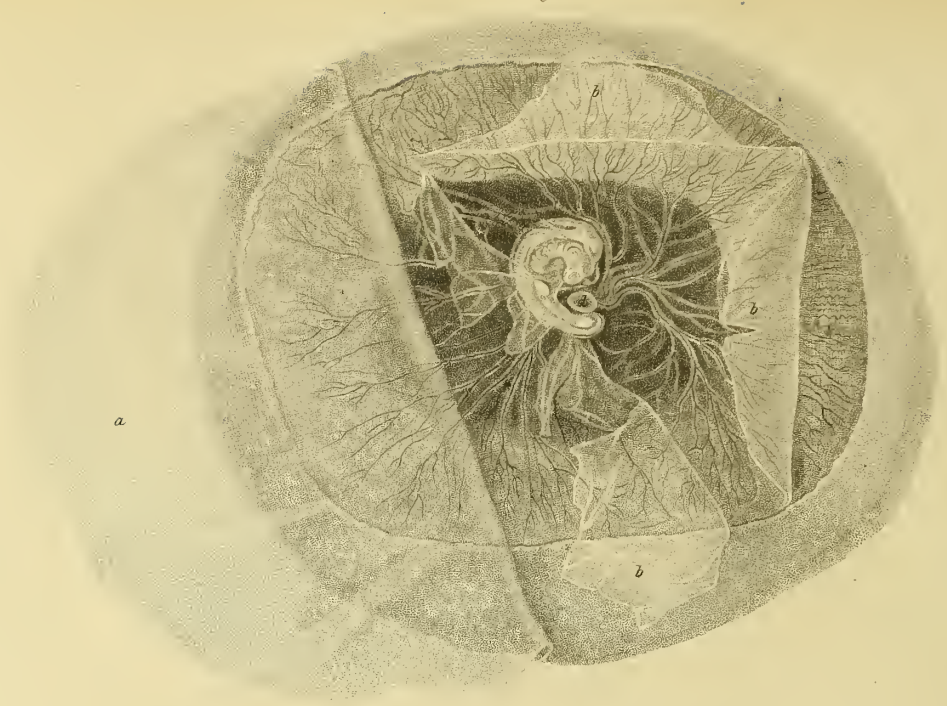


Fig. 3.

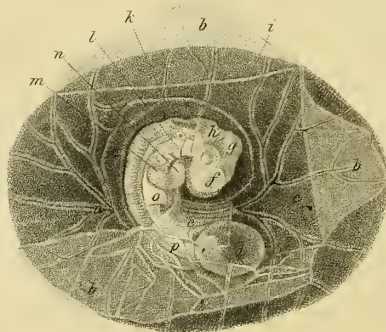


Fig. 2.





- a*, The auricles.
- b*, The right ventricle.
- c*, The left ventricle.
- d*, The aortic bulb.
- e*, The cerebral hemispheres.
- f*, The optic lobes.
- g*, The eye.
- h*, The ear.
- i*, The lateral processes of the upper jaw, as yet ununited anteriorly, leaving a longitudinal fissure in front of the head.
- k*, The right ramus of the lower jaw.
- l*, The rudiment of the wing.
- m*, The rudiment of the leg.
- n*, The reflected amnios.
- o*, The allantois.
- p*, The pedicle continued from the loop of small intestine to the vitelline layer of the germinal membrane or the vitelline.
- q*, The vitelline, or omphalo-mesenteric artery.
- r*, The corresponding vein.
- s*, The evanescent terminal sinus.

### PLATE LXXIII.

The figures in this and the following Plate are designed to show principally the progressive development of the allantois, and its relations to the other membranes of the embryo.

*Fig. 1.* The embryo of a Goose, in its natural position upon the yolk. The attenuated vitelline membrane *a* is reflected from the embryo.

*b, b.* Are portions of the false amnios, or serous layer of the blastoderm reflected from the vascular layer, *c*.

*d*, The allantois. The embryo exhibits the same development of its parts as in Plate LXXI.

*Fig. 2.* A similar preparation of the embryo and its membranes, a little further advanced: a portion of the vascular layer, *c*, is reflected from the mucous layer of the germinal membrane.

*Fig. 3.* The same embryo a little more magnified.

- a*, Vitelline vein.
- b*, Serous layer of the blastoderm reflected from
- c*, Vascular layer of blastoderm.
- e*, The true amnios laid open.
- f*, Cerebral hemispheres.
- g*, Optic lobes.
- h*, Medulla oblongata.
- i*, Eyeball.
- k*, Acoustic vesicle.
- l*, One of the branchial fissures.
- m*, The auricle of the heart.
- n*, The ventricle.
- o*, Rudiment of the wing.
- p*, Rudiment of the leg.

#### PLATE LXXIV.

*Fig. 1.* In this figure the embryo is not much farther advanced than the one last described; but the allantois *d*, from the rapidity of its growth, is much increased in size. The membrana vitelli *a*, though now reduced to an extreme degree of tenuity and transparency, is still shown to exist, and is reflected from the embryo and its proper membranes. Of these, the structure of the germinal membrane is beautifully displayed by the dissection of the serous *b* from the vascular and mucous layers *c*. The place of the reflection of the serous layer from the amniotic sac *e*, which it has formed around the embryo, upon the vascular layer of the blastoderm, is seen to be at the margins of the still open abdomen, into which a bristle is represented as being inserted. The allantois *d*, *d*, is spreading over the vitellus, between the serous and vascular layers of the blastoderm; and its adhesion to the serous layer, or false amnios, has already commenced, and is indicated at the reflected portion of the latter membrane marked *b'*. At this period of its development, the flattened allantois presents the appearance of a bilobed sac.

*Fig. 2.* The yolk supporting the embryo, and invested by the expanded blastoderm. The embryo lies between the allantois and the vascular layer of the blastoderm. The new series of vessels developed upon the allan-



Fig. 1.

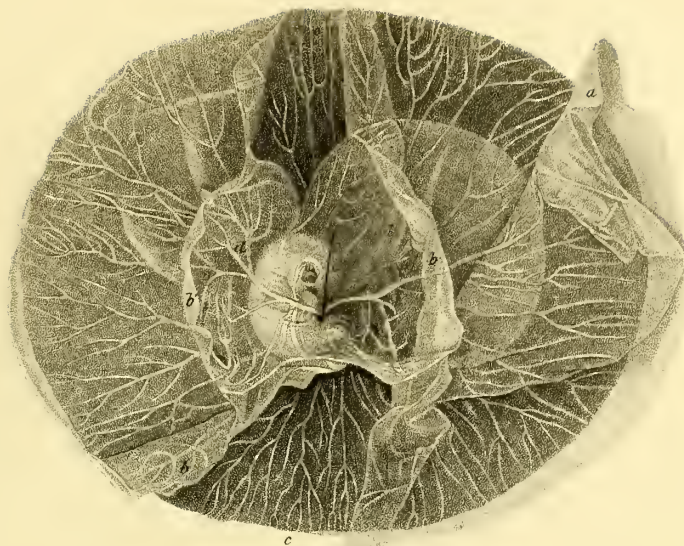


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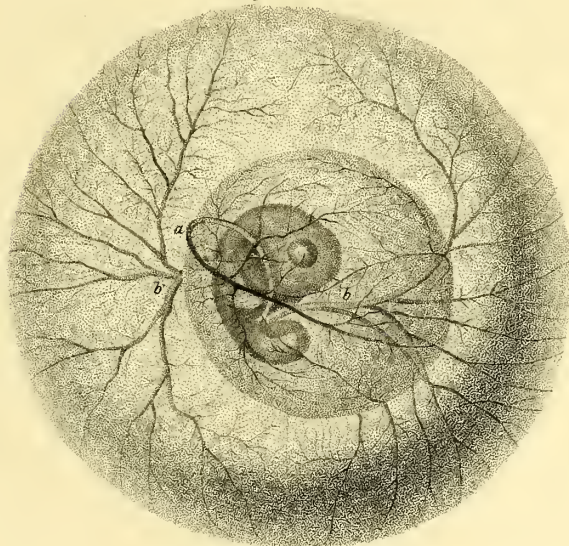


Fig. 3.

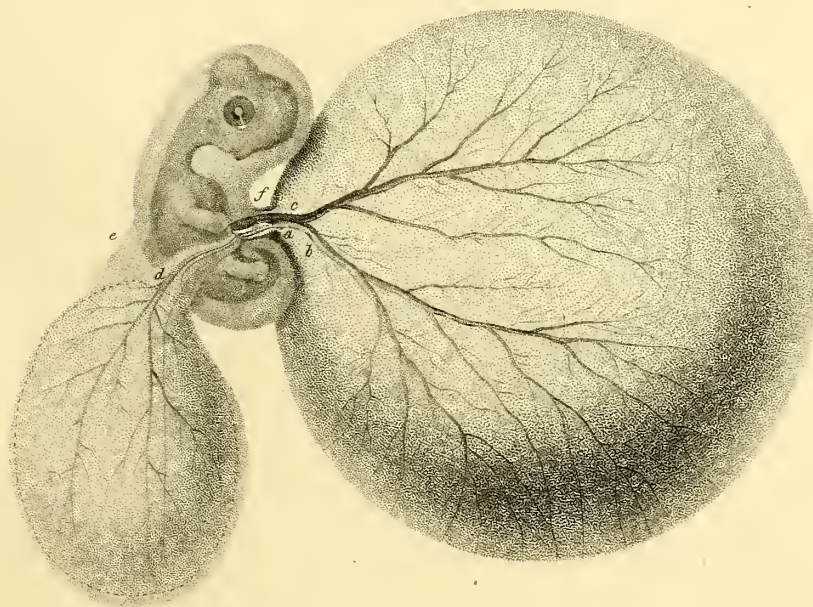








Fig. 2.

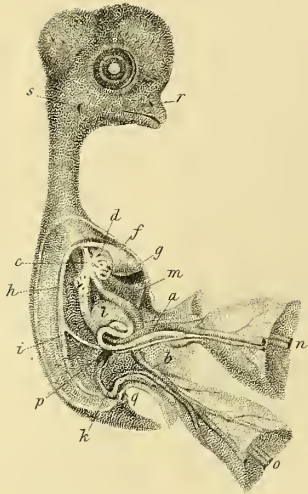


Fig. 3.

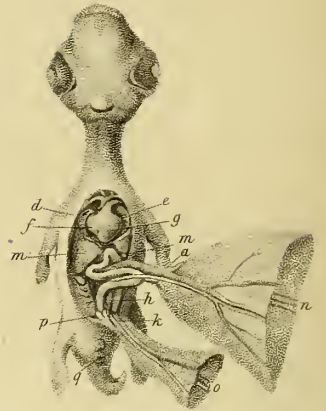


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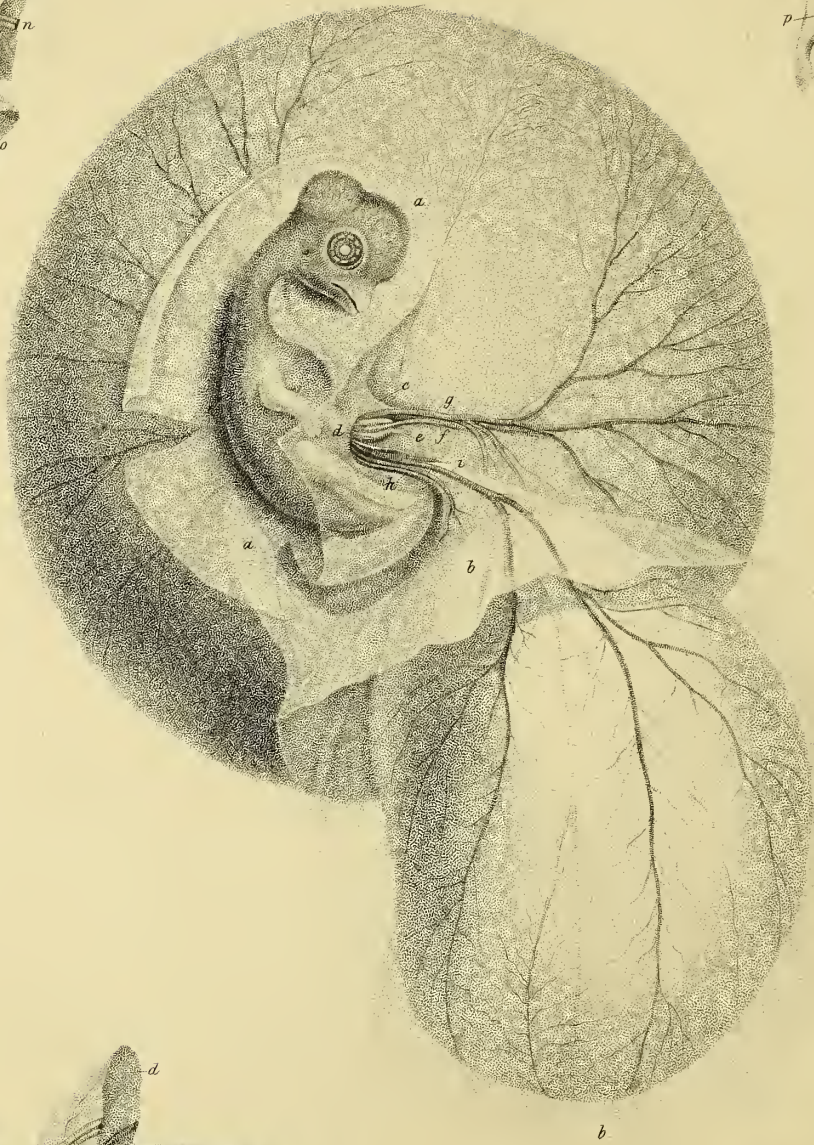


Fig. 5.

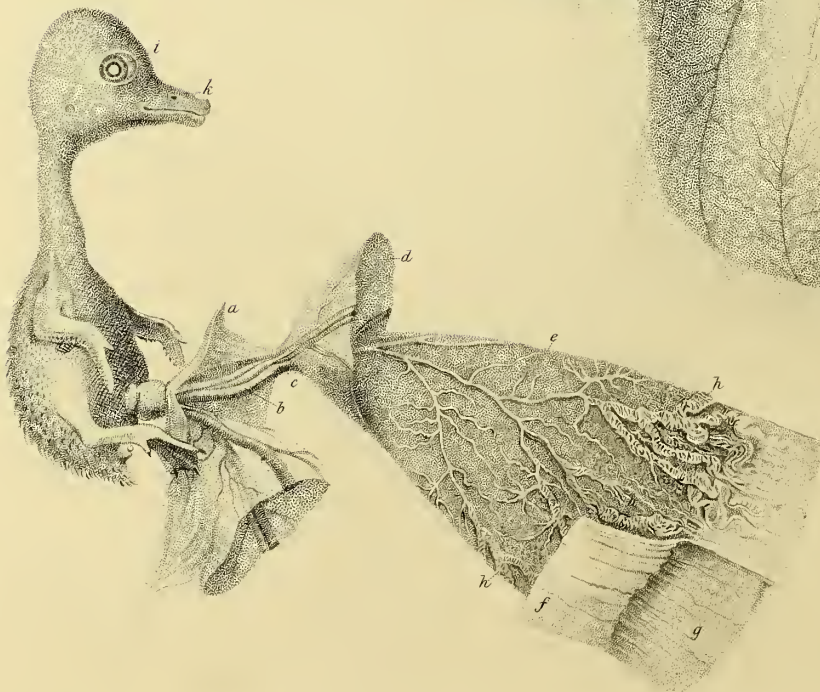
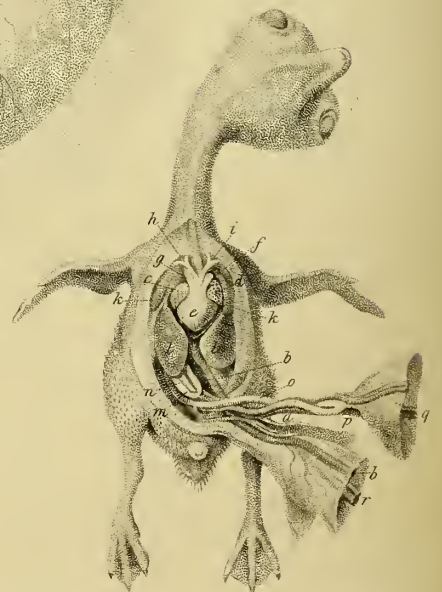


Fig. 4.





tois, and which this membrane is destined to convey to the inner surface of the porous egg-shell, is now exhibited.

*a*, Is the trunk of one of the allantoic or umbilical vessels describing a curve around the circumference of the allantois.

*b, b*, Are the vitelline or omphalo-mesenteric vessels.

*Fig. 3.* This figure gives a side-view of the embryo, and a remarkably clear demonstration of its three membranous sacs; one of which invests it, viz. the amnios, and two are appended to it, viz. the vitelline and allantois. The vitelline, which is the expanded and organized blastoderm, is still widely open at the part of the yolk opposite the embryo, but the terminal sinus at the circumference of this opening is nearly obliterated.

*a*, Is the contracted pedicle which now connects the intestinal with the vitelline divisions of the blastoderm: it is pervious, and is termed the 'ductus vitello-intestinalis.'

*b*, The vitelline artery.

*c*, The vitelline vein. The embryo is raised from the yolk, and the allantois is turned down; it is suspended to the embryo by its pedicle *d*, and by the reflected layer of the false amnios *e*: the continuation of this membrane upon the vitelline is shown at *f*. The fissure of the iris is clearly represented.

#### PLATE LXXV.

*Fig. 1.* The embryo *in situ*, at a more advanced stage of growth (about the twelfth day of incubation), with the yolk and allantois, showing the amniotic covering of the embryo, and its reflection upon the allantois; and the trunks of the omphalo-mesenteric and umbilical vessels, as they pass to the germinal membrane and allantois respectively.

*a*, The embryonic amnios cut open.

*b*, The allantoic amnios laid open.

*c*, The ligament-like process by which the embryonic amnios is reflected upon the germinal membrane or vitelline, forming its serous layer.

*d*, The loop of small intestine.

*e*, The pedicle from the same to the vitelline; it sometimes remains to form a small cæcum in the mature bird.

*f*, Vitelline artery.

*g*, Vitelline vein.

*h*, Allantoic artery.

*i*, Allantoic vein.

*Fig. 2.* The same embryo removed from the egg, and the right parietes of the abdomen dissected off, to show the heart and great vessels *in situ*, and the origins of the vitelline and allantoic vessels.

*Fig. 3.* An embryo at the same period of development, showing the same parts by the removal of the ventral parietes of the thoracic abdominal cavity. The same letters indicate the same parts in both figures.

*a*, The vitelline or omphalo-mesenteric vein, passing beneath the duodenum and stomach to join the inferior cava.

*b*, The allantoic or umbilical vein, passing through the liver and joining the inferior cava above the stomach.

*c*, The junction of the inferior with the superior venæ cavæ, to form the sinus of the auricle.

*d*, The right auricle.

*e*, The left auricle (*Fig. 3.*).

*f*, The right ventricle.

*g*, The left ventricle.

*h*, The descending aorta.

*i*, The origin of the vitelline or omphalo-mesenteric artery.

*k*, The allantoic or umbilical artery.

*l*, The stomach.

*m*, The liver.

*n*, Cut edge of the vitellicle.

*o*, Cut edge of the allantois.

*p*, The two cæca.

*q*, The cloaca.

*r*, The nostril.

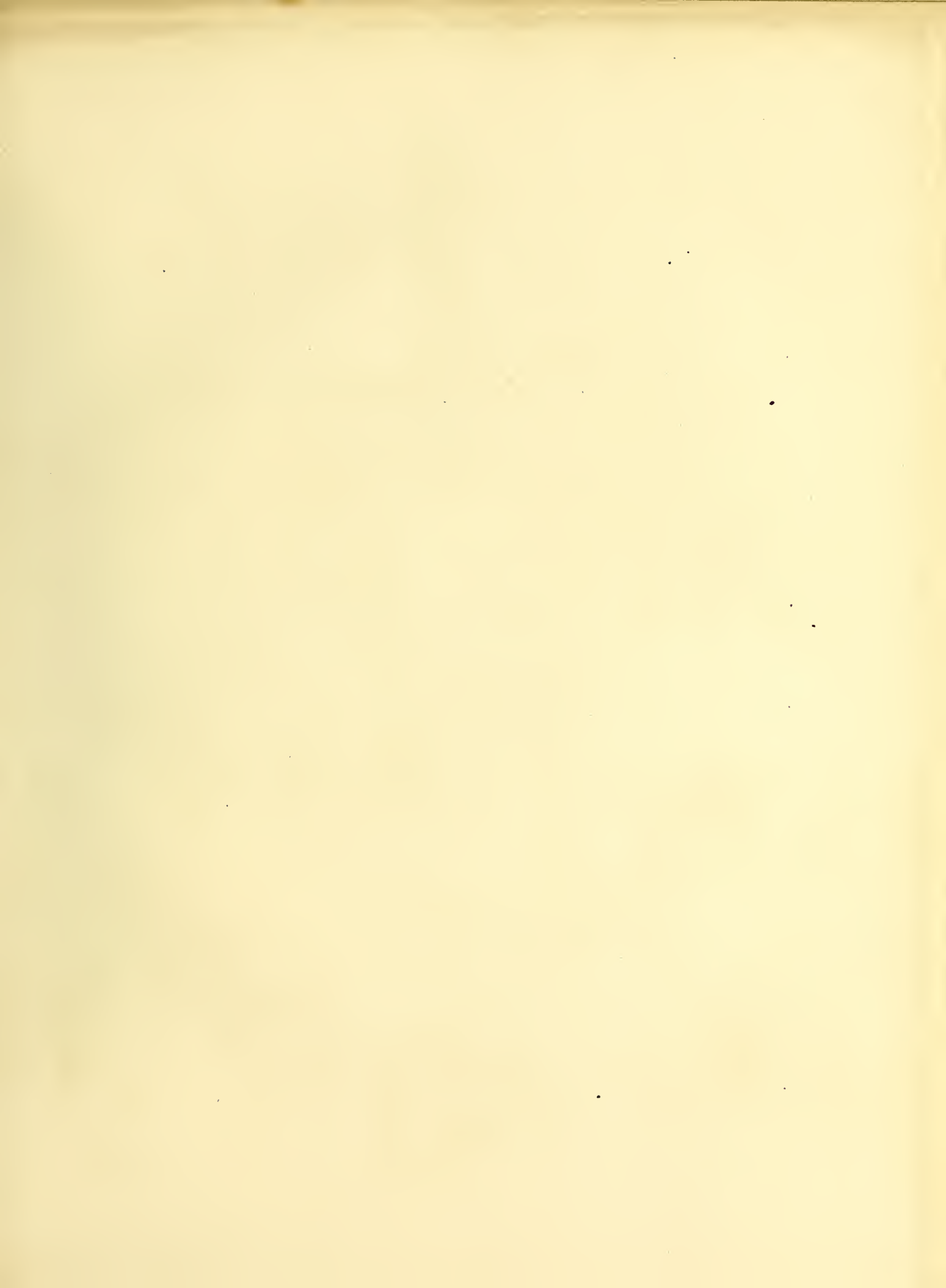
*s*, The meatus auditorius.

*Fig. 4.* A fœtal Goose at a later period of incubation, with the anterior parietes of the abdomen cut away, to show a further progress in the development of the contained viscera. The duodenal loop and pancreas are here shown.

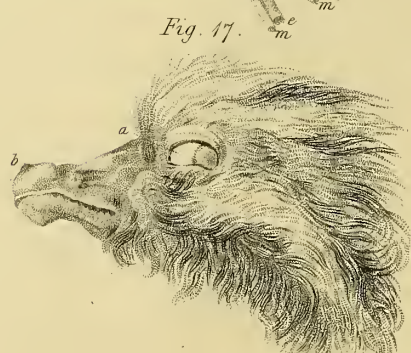
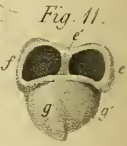
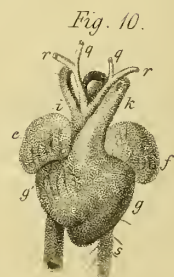
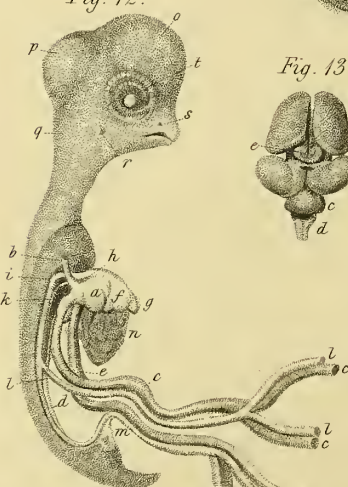
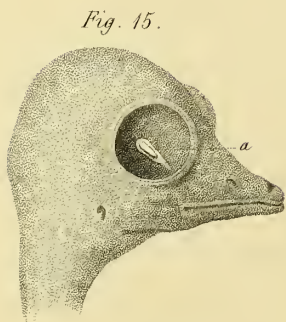
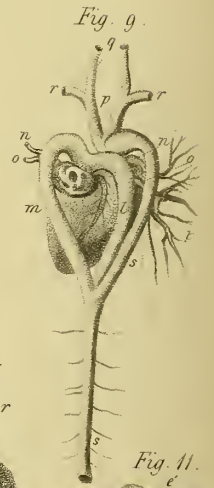
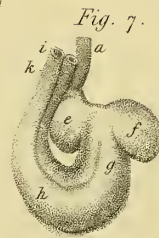
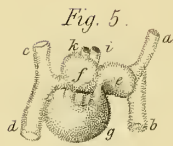
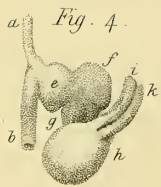
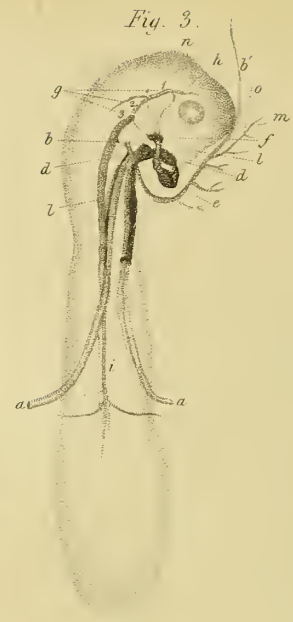
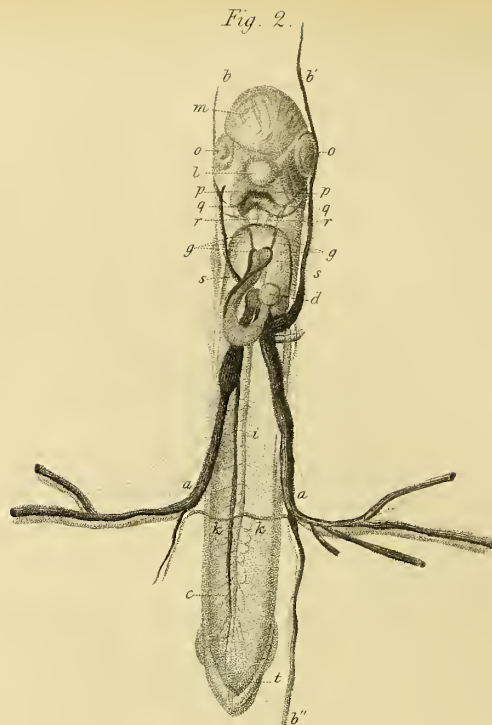
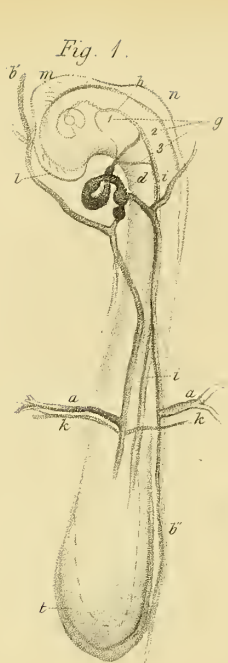
*a*, The vitelline vein.

*b, b*, The allantoic vein.

*c*, The right auricle.







- d*, The left auricle.
- e*, The ventricular portion of the heart.
- f*, The vessel which becomes the trunk of the pulmonary artery.
- g*, The vessel which forms the descending aorta.
- h*, The right arteria innominata.
- i*, The left arteria innominata.
- k, k*, The lungs.
- l, l*, The two lobes of the liver.
- m*, The duodenal loop.
- n*, The pancreas.
- o*, The vitelline loop of the ileum.
- p*, The pedicle of the vitellicle.
- q*, The cut edge of the vitellicle.
- r*, The cut edge of the allantois.

*Fig. 5.* A foetal Goose at the same stage of growth, with the neck of the allantois, and the vitellicle dissected to show its structure.

- a*, A portion of the amnios of the foetus, reflected from the short and wide umbilical cord.
- b*, The vitelline loop of small intestine continued into the cord.
- c*, The pedicle of the vitellicle, or yolk-bag.
- d*, The cut edge of the vitellicle.
- e*, The inner surface of the mucous layer of the vitellicle.
- f*, A portion of the same reflected from
- g*, The vascular and serous layers.
- h, h*, The vascular and plicated folds of the mucous layer of the vitellicle, called 'vasa lutea' by Haller.
- i*, Rudiment of the membrana nictitans.
- k*, Horny knob for breaking the shell, which disappears after exclusion.

#### PLATE LXXVI.

*Fig. 1.* Embryo of the Goose, exhibiting the condition of the vascular system at the fourth day of incubation, viewed from the left side.

*Fig. 2.* The same, with the development of the parts of the head, viewed from the front or ventral aspect.

*Fig. 3.* The same, viewed from the right side.

*a, a*, Transverse vitelline veins.

- b, b*, Anterior, or superior longitudinal vitelline veins. The right longitudinal vein becomes the right or normal superior cava, and receives the remains of the right transverse vein in the character of the right vena azygos.
- b'*, The left longitudinal vein; this is persistent in the adult as the left superior cava, and enters then, as now, the lower part of the auricle.
- b''*, The posterior or inferior longitudinal vitelline vein.
- c*, The vertebral vein, or rudiment of the abdominal vena cava.
- d*, The auricle.
- e*, The ventricle.
- f*, The aortic bulb.
- g*, 1, 2 and 3, Primitive aortic or branchial arches.
- h*, The cerebral or carotid artery.
- i*, The descending aorta.
- k, k*, Vitelline or omphalo-mesenteric arteries.
- l*, Cerebral hemispheres.
- m*, Optic lobes, or bigeminal bodies.
- n*, Acoustic lobe, or medulla oblongata.
- o*, Eyeball.
- p*, Superior maxillary branches.
- q*, Inferior maxillary branches.
- r*, Hyoidian branches.
- s*, Upper boundary of thoracic abdominal cavity, the 'fovea cardiaca' of Wolff.
- t*, The lower or pelvic boundary of the same cavity; which, at this period, is widely open anteriorly. The intestinal and mesenteric folds are not figured.
- Fig. 4.* The heart of the embryo of a Goose at the fourth day of incubation, viewed from the anterior or ventral aspect.
- Fig. 5.* The same, viewed from the posterior or dorsal aspect.
- Fig. 6.* The same, after a section has been removed from the base of the aortic bulb, showing the commencing 'septum ventriculorum' *g''*.
- Fig. 7.* The heart of a somewhat younger embryo of a Goose, showing the ventricular or arterial division, still in the form of an elongated, dilated and curved vessel, partially divided lengthwise, but not yet transversely, into the ventricle and bulbus arteriosus.
- Fig. 8.* The heart of the embryo of a Goose at a later period of development.



*Fig. 9.* The same, at near the conclusion of incubation, showing, from the dorsal aspect, the two 'ductus arteriosi' *l* and *m*.

*Fig. 10.* The same, viewed from the sternal aspect, showing the development of the right ventricle *g'*, from the base of the left or normal ventricle.

*Fig. 11.* The same, viewed from the dorsal aspect, after a section has been removed from the auricles to show their septum *e'*.

The same letters indicate the same parts in each figure.

- a*, The termination of the right superior or longitudinal vitelline vein, which is persistent as the right superior vena cava, and becomes the normal superior or anterior vena cava in Man and most Mammalia.
- b*, The termination of the right transverse vitelline vein, the remains of which are persistent in the adult as the right vena azygos.
- c*, (*Fig. 5.*) The termination of the left superior longitudinal vitelline vein, which is persistent as the left superior cava in Birds and Implacental Mammalia, and the remains of which constitute the vena innominata in Man and most Placental Mammalia.
- d*, The termination of the left transverse vitelline vein, which becomes the left vena azygos, and receives, at its termination, the subsequently developed inferior or posterior vena cava *d''*, *Fig. 8*.
- e*, The right division of the now single auricle.
- f*, The left division of the auricle, afterwards appropriated to the pulmonary veins.
- g*, The ventricle; *g'*, its right division, afterwards appropriated to the pulmonary artery; *g''*, its septum, which commences, as shown in *Fig. 6*, at the base of the aortic bulb.
- h*, The aortic bulb.
- i*, The right division of the aorta, which is persistent as the arch of the descending aorta.
- k*, The division of the aorta, which is retained as the pulmonary artery.
- l*, The right ductus arteriosus.
- m*, The left ductus arteriosus.
- n, n*, Pulmonary artery, which, by enlarging, retain the left division of the aortic trunk as their stem.
- o, o*, Pulmonary veins.
- p*, The arteriæ innominatæ.
- q*, The carotid arteries.

*r*, The subclavian arteries.

*s*, The descending aorta.

*t*, (*Fig. 9*.) Outline of the right lung.

*Fig. 12*. The embryo of a Goose at about the twelfth day of incubation, dissected to show the chief vascular trunks at that period.

*a*, The right auricle.

*b*, The right superior vena cava; it is the persistent portion of the right longitudinal vitelline vein (*b*, *Fig. 2*, and *a*, *Fig. 4*).

*c*. The omphalo-mesenteric vein, corresponding with the right transverse vitelline vein of the earlier embryo. It has now passed through its first phasis, and has taken on its second functional character as the sole channel of the returning blood from the vitelline circulation. Of the three previously existing venous channels, the right superior longitudinal vein is converted, as above mentioned, into the right vena innominata, or superior cava; the left superior longitudinal vitelline vein is in like manner restricted to the return of blood from the left side of the head and left wing of the embryo, in the character of the left superior cava. It still communicates with the remains of the left transverse vitelline vein, now reduced to the functions of the left vena azygos. The inferior longitudinal vitelline vein has been reduced to the commencement of the abdominal vena cava *d*, which has now acquired a large size from the circumstance of its having become the channel for transmitting to the heart the blood from the rapidly-developing abdominal viscera and the allantois.

*e*, The allantoic or umbilical vein.

*f*, The right ventricle.

*g*, The apex of the left ventricle.

*h*, The origin of the pulmonary artery, now part of the aorta.

*i*, The right and persistent arch of the aorta.

*k*, The left and transitory arch of the aorta, forming one of the long ductus arteriosi; it is persistent in Reptiles.

*l*, The vitelline or omphalo-mesenteric artery.

*m*, The allantoic or umbilical artery.

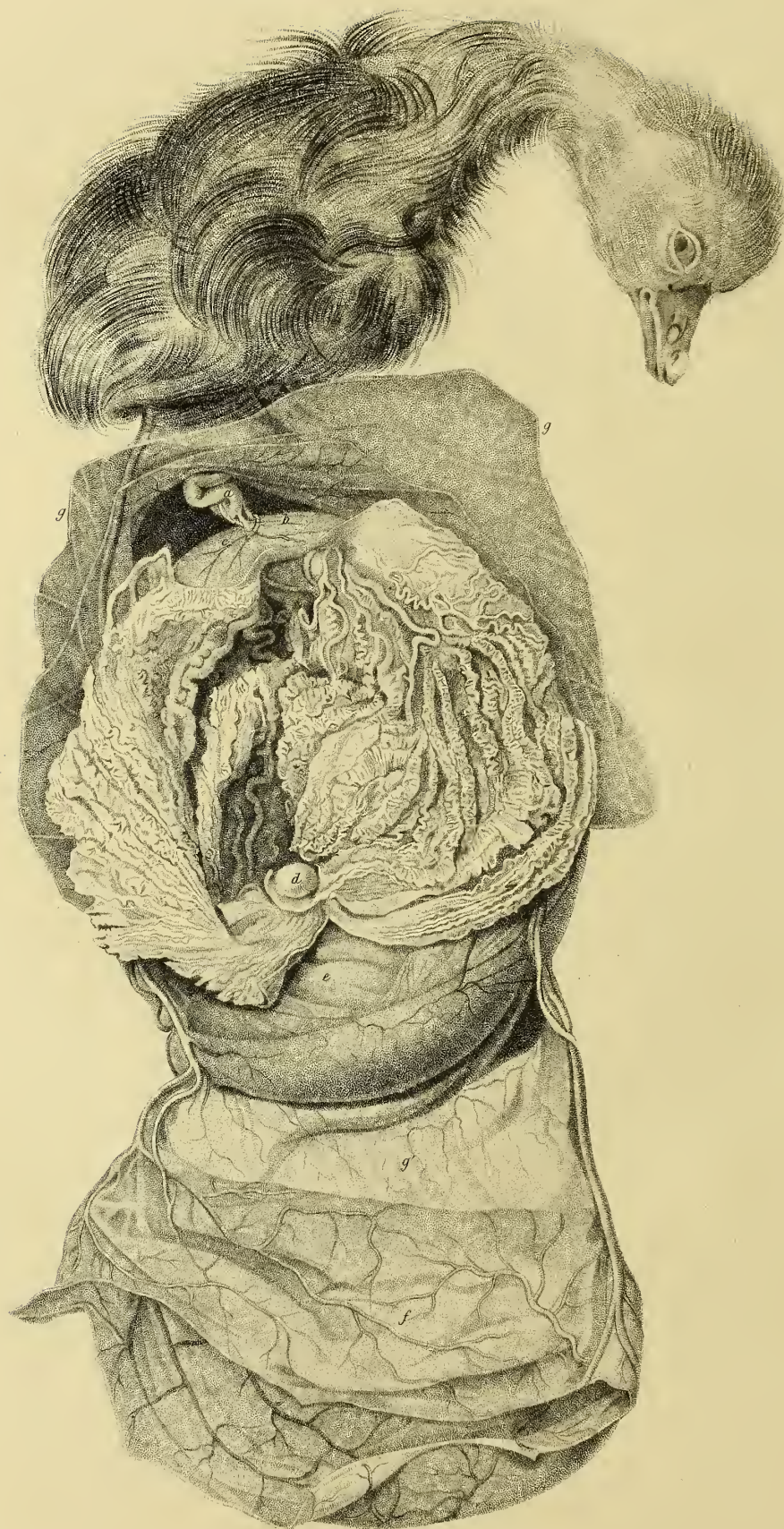
*n*, A portion of the liver.

*o*, The cerebral hemispheres.

*p*, The optic lobes.







- q*, The medulla oblongata.
- r*, The meatus auditorius externus.
- s*, The nostril.

*t*, The eyeball, as yet unprotected by eyelids.

*Fig. 13.* The brain of the embryo of a Goose at about the tenth day of incubation ; viewed from above.

*Fig. 14.* The same, viewed from below.

- a*, The cerebral hemispheres.
- b*, The optic lobes, or bigeminal bodies.
- c*, The cerebellum.
- d*, The medulla oblongata.
- e*, Pineal gland, and the third ventricle ; in *Fig. 14* the same letter marks the base of the third ventricle.
- f*, The pituitary gland.
- g*, Crura cerebri.
- h*, Olfactory nerves.
- i*, Optic nerves.

*Fig. 15.* The head of a Gosling at the twentieth day of incubation, with the anterior parts of the eye dissected out to show the rudiment of the marsupium, or pecten *a*, now beginning to be developed.

*Fig. 16, 17 and 18* show the progressive development of the eyelids, and of the horny knob on the upper mandible.

- a*, The membrana nictitans, which is the first of the eyelids to acquire its full proportional size. In *Fig. 18*, the eyeball is seen to be covered principally by the growth of the lower eyelid, which, in birds, is more extensive and moveable than the upper lid, and is principally used to close the eye.
- b*, The horny shell-breaking deciduous process of the upper mandible.

## PLATE LXXVII.

A Gosling at the twenty-fifth day of incubation, with its saccular appendages, removed from the egg, and the vitellicle laid open to show the vascular wavy folds of its lining membrane, called the 'vasa lutea,' and the orifice by which it receives the remaining inspissated albumen.

- a*, The vitelline loop of small intestine.
- b*, The vitelline duct.



- c*, The vitelline artery.
- d*, The aperture, circumscribed by the *circulus venosus*, by which is received
- e*, The remains of the albumen.
- f*, The allantois.
- g, g*, Portions of the true amnios, reflected from the fœtus upon the vitellicle.
- g'*, A portion of the false amnios (serous layer of the primitive blastoderm), which the allantois has carried along with it, and which still connects it with the vitellicle.

### PLATE LXXVIII.

- A Gosling near the close of incubation, dissected to show the condition of the connective processes and vessels of the two great fœtal appendages, viz. the vitellicle and allantois \*.
- a*, A bristle placed behind the attenuated canal of communication between the vitellicle and the intestine: in its present condition it is usually called the 'vitelline duct,' or ductus vitello-intestinalis.
  - b*, A bristle placed behind the vitelline, or omphalo-mesenteric artery.
  - c*, The vitelline, or omphalo-mesenteric vein joining the abdominal cava.
  - d, d*, Lobes of the vitellicle, or yolk-sac, not yet taken into the abdomen.
  - e*, The rectum.
  - f*, The urachus, or attenuated canal of communication between the allantois and the termination of the rectum, into which gut a bristle is seen passing from both the urachus and the cloacal aperture.
  - g*, The allantoic, umbilical or hypogastric arteries.
  - h*, The umbilical, or allantoic vein.
  - i*, The heart.
  - k*, The liver; the left lobe has been dissected away.
  - l*, The proventriculus, cut through.
  - m*, The kidney.
  - n*, A portion of the amnios.

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\* The specimen here figured is No. 3427.







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Species, *Moschus Moschiferus*, Musk-deer. Nos. 2114, 2115, 2116, 2116A, 2117.

Genus, *Moschus (Tragulus)*, Pigmy Musk-deer. Nos. 735, 1786, 2754.

Species, *Cervus Dama*, Fallow-deer. Nos. 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 1149, 1365, 1408, 1615, 1616, 1938, 1939, 1940, 1941, 2152, 3515A, 3516, 3517.

Species, *Cervus Tarandus*, Rein-deer. Nos. 561, 563A, 937, 2101, 2152A, 2755.

- Species, *Cervus Canadensis*, Wapiti. Nos. 566A, 723B.  
 Species, *Cervus giganteus*, Irish Elk. No. 123.  
 Species, *Camelopardalis Giraffa*, Giraffe. Nos. 1150, 1151, 1152, 2755A, 3528A.  
 Species, *Antilope picta*, Nilghau. No. 1237.  
 Species, *Antilope Cervicapra*, Indian Antelope. Nos. 2096, 2097, 2098.  
 Species, *Antilope Corinna*, Corinne Antelope. No. 2113.  
 Genus, *Antilope*. Nos. 2099, 2100, 2102.  
 Species, *Capra Hircus*, Goat. Nos. 557, 564, 2556, 2761, 2762.  
 Species, *Ovis Aries*, Sheep. Nos. 558, 562, 563, 565, 566, 1147, 1327, 1711A, 1826, 1827, 1828, 2074, 2075, 2152B, 2555, 2763, 2764, 3481, 3482, 3483, 3484, 3485, 3486, 3487, 3488, 3489, 3490, 3491, 3492, 3493, 3494, 3495, 3496, 3497, 3498, 3498A, 3682, 3683, 3684, 3685, 3686, 3722, 3725, 3727A.  
 Species, *Bos Taurus*, Common Ox. Nos. 5, 33, 49, 73, 138, 139, 140, 141, 142, 143, 144, 150, 151, 152, 153, 154, 155, 156, 160, 269, 270, 271, 286, 555, 556, 559, 564A, 564B, 836A, 868, 868A, 868B, 946, 1148, 1199A, 1252, 1253, 1254, 1255, 1256, 1328, 1412, 1413, 1556, 1704, 1705, 1728, 1785, 1800, 1803C, 1813A, 2015, 2016, 2017, 2018, 2019, 2020, 2038, 2072, 2558, 2559, 2757, 2758, 2759, 2760, 3499, 3500, 3501, 3502, 3503, 3504, 3505, 3506, 3507, 3508, 3509, 3510, 3511, 3512, 3513, 3514, 3515, 3687, 3688, 3689, 3690, 3691, 3691A, 3718, 3721, 3727B, 3727C, 3751.  
 Species, *Bos Indicus*, var. *minor*, Zebu. No. 2557.  
 Species, *Bos Bison*, Bison. Nos. 560, 1258, 2756.

#### Order BRUTA.

- Species, *Bradypus didactylus*, Two-toed Sloth. Nos. 255H, 390, 1279, 2752, 2753.  
 Species, *Bradypus tridactylus*, Three-toed Sloth. Nos. 255G, 1154, 2753A, 3480.  
 Species, *Dasypus sex-cinctus*, Weasel-headed Armadillo. Nos. 543B, 729A, 2562A.  
 Species, *Dasypus Peba*, Nine-banded Armadillo. Nos. 543C, 772B, 772C, 1501, 1899, 2132, 2560, 2561, 2562, 2753B, 3479, 3720.  
 Species, *Orycteropus capensis*. No. 3477.  
 Species, *Myrmecophaga didactyla*, Two-toed Anteater. Nos. 282M, 1502, 1503.  
 Species, *Manis pendatactyla*, Long-tailed Manis, or Pangolin. Nos. 543, 543A, 1925, 1926, 2133, 2134.  
 Species, *Manis brachyura*, Short-tailed Manis. Nos. 590C, 3478.

#### Order RODENTIA.

- Species, *Sciurus vulgaris*, Common Squirrel. Nos. 1323F, 2746, 3470.  
 Species, *Sciurus cinereus*, Gray Squirrel. Nos. 1415, 1952, 2498.  
 Species, *Sciurus striatus*, var. *Americanus*, Squirrel. No. 2747.  
 Genus, *Sciurus*, Squirrel. No. 2499.  
 Species, *Pteromys Petaurista*, Flying Squirrel. Nos. 1707, 1708.



- Species, *Arctomys Marmota*, Marmot. No. 2748.  
 Species, *Mus decumanus*, Norway Rat. Nos. 447, 809, 1130, 1908, 2500, 2501, 3466, 3467, 3468.  
 Species, *Mus musculus*, Mouse. Nos. 729, 2503, 2504, 3469, 3469A, 3753.  
 Species, *Mus giganteus*, Bandicoot Rat. No. 3752.  
 Species, *Capromys Fournieri*, Capromys. Nos. 810A, 2497A, 2497B.  
 Species, *Myoxus Glis*, Dormouse. No. 590A.  
 Species, *Arvicola amphibius*, Water Vole. Nos. 808, 3462, 3463, 3464, 3465.  
 Species, *Arvicola arvensis*, Field Vole. No. 3790.  
 Species, *Dipus Sagitta*, Jerboa. Nos. 1225, 1599.  
 Species, *Helamys capensis*, Jumping-hare. No. 2563.  
 Genus, *Orycterus*, Sand-mole. No. 2749.  
 Species, *Bathyergus Capensis*, Cape Mole. Nos. 2745.  
 Species, *Castor Fiber*, Beaver. Nos. 261, 355, 587, 588, 589, 590, 1323E, 1407, 1927, 1928, 1951, 2118, 2119, 2120, 2121, 2122, 2483, 2484, 2485, 2486, 2487, 2742.  
 Species, *Hystrix cristata*, Porcupine. Nos. 356, 357, 357A, 357B, 544A, 726F, 923D, 1978, 1979, 3476.  
 Species, *Hystrix dorsata*, Canada Porcupine. No. 2750.  
 Species, *Lepus timidus*, Hare. Nos. 727, 728, 1551A, 2135, 2489, 2490, 3472A.  
 Species, *Lepus variabilis*, Norway Hare. No. 544.  
 Species, *Lepus Cuniculus*, Rabbit. Nos. 1507, 1614, 1725, 1787, 2743, 2744, 3471, 3472.  
 Species, *Chinchilla lanigera*, Chinchilla. No. 726G.  
 Species, *Cavia porcellus*, Guinea-pig. Nos. 1280, 2491, 3473.  
 Species, *Cælogenyx subfusca*, Spotted Cavy. Nos. 1506, 1709, 2139, 2495, 2496, 2497.  
 Species, *Cælogenyx subniger*, Paca. Nos. 1171, 1182.  
 Species, *Dasyprocta Acuchi*, Acouchi. Nos. 2492, 2492A.  
 Species, *Dasyprocta Agouti*, Agouti. Nos. 723C, 839, 1323G, 2493, 2494, 2751, 3474.

### Sub-Class *IMPLACENTALIA*.

#### Order *MARSUPIALIA*.

- Species, *Dasyurus Maugei*, Mauge's Dasyure. No. 1323C.  
 Species, *Dasyurus viverrinus*, Viverrine Dasyure. No. 2734F.  
 Species, *Phascogale penicillata*, Tufted Phascogale, or Tapao Tafa. No. 3758.  
 Species, *Didelphys marsupialis*, Opossum. No. 541.  
 Species, *Didelphys Opossum*, Opossum. No. 3759.  
 Species, *Didelphys dorsigera*, Dorsigerous Opossum. Nos. 2471, 2734C, 3777.  
 Species, *Didelphys brachyura*, Short-tailed Opossum. Nos. 1227, 2472, 2473.  
 Species, *Didelphys Virginiana*, Virginian Opossum. Nos. 1323B, 1823, 2476, 2481, 2735, 2736, 2737, 2738, 2738A, 3760.

Genus, *Didelphys* —? Opossum. No. 2479.

Species, *Phalangista vulpina*, Vulpine Phalanger. Nos. 1504, 2475, 2480, 3764.

Species, *Phalangista gliriformis*, Gliriform Phalanger. Nos. 3761, 3765.

Species, *Phalangista fuliginosa*, Sooty Phalanger. No. 2477A.

Species, *Petaurus taguanoides*, Great Petaurist. Nos. 2734E, 3762, 3763.

Species, *Petaurus pygmaeus*, Pigmy Petaurist. Nos. 2734D, 3761A, 3761B.

Species, *Phascolarctos fuscus*, Koala. Nos. 282H, 2482A.

Species, *Macropus major*, Great Kangaroo. Nos. 283, 553A, 726E, 838, 923C, 1153, 1228, 1505, 2474, 2482, 2739, 2740, 2740A, 2740B, 2740C, 3460C, 3460D, 3460E, 3460F, 3461, 3765A, 3766, 3767, 3767A, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776.

Species, *Hypsiprymnus murinus*, Murine Potoroo. Nos. 2478, 2741.

Species, *Phascalomys Vombatus*, Wombat. Nos. 590B, 2482B, 2738B.

#### Order MONOTREMA.

Species, *Echidna Hystrix*, Spiny Echidna. Nos. 255D, 282I, 541C, 1503A, 1546B, 3741E.

Species, *Ornithorhynchus paradoxus*, Ornithorhynchus, or Duck-mole. Nos. 255C, 271A, 281A, 323B, 541A, 541B, 753A, 1503B, 1546A, 2164B, 2734A, 2734B, 3460A, 3741A, 3741B, 3741C, 3741D.

#### Class AVES.

##### Order ACCIPITRES.

Species, *Vultur Papa*, King Vulture. Nos. 309, 1485.

Species, *Aquila Chrysaetos*, Golden Eagle. Nos. 522A, 1482, 1538.

Genus, *Aquila*, Eagle. Nos. 1400, 1796, 1797.

Species, *Haliaeetus albicilla*, Sea-eagle. Nos. 1483, 1539, 1540.

Species, *Pandion Haliaeetus*, Osprey. No. 1484.

Species, *Bubo maximus*, Great Horned Owl. Nos. 1749, 1755, 1798.

Species, *Otus aurita*, Horn-owl. Nos. 1581, 1799.

Genus, *Strix* —? Owl. Nos. 210, 211, 212, 1481, 1581, 1750, 1751, 1798.

##### Order PASSERES.

Species, *Merula vulgaris*, Black-bird. Nos. 2002, 2003, 2004, 2005, 2006.

Species, *Sylvia modularis*, Nightingale. No. 3789.

Species, *Turdus musicus*, Thrush. Nos. 1752, 1753, 1754.

Species, *Motacilla lugubris*, Wagtail. No. 3788.

Species, *Pyrigita domestica*, House-sparrow. Nos. 685, 2457, 2458, 2459, 2460, 2461, 2462, 2728, 3375, 3376.

Species, *Hirundo esculenta*, Edible-nest Swallow. Nos. 582B, 3787C, 3787D, 3787E, 3787F.

- Genus, *Hirundo* — ? Swallow. No. 1822.  
 Species, *Corvus Corax*, Raven. Nos. 524A, 1161, 1480.  
 Species, *Corvus Corone*, Crow. Nos. 524B, 1745, 1746, 1747.  
 Species, *Corvus frugilegus*, Rook. Nos. 524C, 2462C.  
 Genus, *Trochilus* — ? Humming Bird. No. 282C.  
 Species, *Nectarinia cærulea*, Blue Honey-bird. No. 312.  
 Species, *Glaucopis cinerea*, Wattle-bird. No. 310.

## Order SCANSORES.

- Species, *Picus viridis*, Woodpecker. Nos. 311, 1477, 1478, 1479, 1479A.  
 Species, *Cuculus canorus*, Cuckoo. Nos. 534, 1183A, 2462A, 2462B, 3376A, 3376B, 3377, 3455.  
 Species, *Ramphastos Ariel*, Ariel Toucan. Nos. 524D, 1479B.  
 Species, *Lorius Domicella*, Lory. No. 1479A.  
 Species, *Psittacus Taitianus*, Tahiti Parrot. No. 282L.  
 Genus, *Psittacus* — ? Parrot. No. 446A.

## Order GALLINÆ.

- Species, *Columba coronata*, Crown Pigeon. Nos. 525, 583, 2727.  
 Species, *Columba Ænas*, Pigeon. Nos. 526, 527, 3737, 3738, 3739, 3740, 3741.  
 Species, *Penelope cristata*, Guan. Nos. 687, 688, 817.  
 Species, *Crax Yarrellii*, Red-knobbed Curassow. No. 688A.  
 Species, *Crax Alektor*, Crested Curassow. No. 1158.  
 Species, *Meleagris Gallopavo*, Turkey. Nos. 528, 1196, 1748, 1755C, 1880, 1881.  
 Species, *Meleagris ocellata*, Honduras Turkey. No. 528A.  
 Species, *Numida Meleagris*, Guinea-fowl. No. 688B.  
 Species, *Phasianus Gallus*, Common Fowl. Nos. 46, 48, 80, 188, 189, 213, 871, 1125, 1126, 1803B, 1911, 2011A, 2030, 2031, 2032, 2033, 2056, 2056A, 2057, 2071, 2453, 2729, 2730, 2732, 3378, 3379, 3380, 3381, 3382, 3389, 3439, 3440, 3441, 3442, 3443, 3444, 3448, 3459, 3460.  
 Species, *Phasianus pictus*, Golden Pheasant. No. 2011B.  
 Species, *Tetrao Scoticus*, Red Grouse. No. 313.  
 Species, *Perdix rubra*, Red-legged Partridge. No. 1358.  
 Species, *Perdix cinerea*, Partridge. No. 3452.

## Order CURSORES.

- Species, *Struthio Camelus*, Ostrich. Nos. 3, 4, 47, 70, 71, 72, 214, 215, 216, 217, 218, 219, 251, 252, 253, 254, 272, 274, 275, 276, 458, 533, 533D, 533E, 533F, 584, 585, 586, 677, 678, 679, 680, 681, 682, 683, 684, 689, 690, 691, 692, 750, 818, 923, 1127, 1155, 1156, 1159, 1195, 1274, 1322, 1323, 1352, 1353, 1354, 1355, 1356, 1357,



1401, 1474, 1474A, 1744, 1755A, 1755B, 1794, 1795, 1811, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1910, 1923, 1924, 1998, 1999, 2469, 2470, 2734, 3385.

Species, *Rhea Americana*, Rhea. Nos. 533C, 923A, 1475.

Species, *Dromaius Novæ-Hollandiæ*, Emeu. Nos. 533A, 583A, 749, 923B, 1744A, 1744B, 2468.

Species, *Casuarius galeatus*, Cassowary. Nos. 533B, 1476, 2456A.

#### Order GRALLÆ.

Species, *Otis tarda*, Bustard. No. 2454.

Species, *Grus Antigone*, Cyrus Crane. No. 2726.

Species, *Ardea cinerea*, Heron. No. 2131.

Species, *Ardea Caboga*, Heron. No. 522.

Species, *Botaurus stellaris*, Bittern. Nos. 684B, 2007, 2008.

Species, *Nycticorax purpureus*, Night-heron. Nos. 520, 521, 2009, 2010.

Species, *Ciconia Argala*, Gigantic Stork. Nos. 519A, 1473.

Species, *Ciconia Marabou*, Marabou Stork. No. 519B.

Species, *Ciconia alba*, White Stork. No. 872.

Species, *Platalea leucorodia*, Spoon-bill. Nos. 314, 684A, 1402.

Species, *Ibis rubra*, Scarlet Ibis. No. 1981.

Species, *Phænicopterus ruber*, Flamingo. Nos. 524E, 686A, 1470, 1471.

#### Order PALMIPEDES.

Species, *Alca Alle*, Auk. No. 522C.

Species, *Fratercula arctica*, Puffin. No. 315.

Species, *Aptenodytes Patagonica*, Patagonian Penguin. No. 2011.

Species, *Larus marinus*, Common Gull. Nos. 522D, 523.

Species, *Larus argentatus*, Gull. No. 686.

Species, *Rhynchops nigra*, Black Skimmer. No. 316.

Species, *Pelecanus onocrotalus*, Pelecan. Nos. 519, 582, 675, 676, 1197, 1472.

Species, *Sula Bassana*, Gannet. Nos. 458A, 522B, 582A, 1160, 1988A.

Species, *Anas Boschas*, Duck. Nos. 672, 803, 889, 1124, 1163, 1164, 2733, 3383, 3429, 3430, 3431, 3432, 3435, 3436.

Species, *Anas moschata*, Muscovy Duck. No. 317.

Species, *Anser palustris*, Goose. Nos. 673, 779, 1080, 1319, 1320, 1321, 1342, 1832, 1980, 1982, 1983, 1984, 1985, 1986, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 2000, 2001, 2111, 2465, 2466, 2731, 3384, 3386, 3387, 3388, 3390, 3391, 3392, 3393, 3394, 3395, 3396, 3397, 3398, 3399, 3400, 3401, 3402, 3403, 3404, 3405, 3406, 3407, 3408, 3409, 3410, 3411, 3412, 3413, 3414, 3415, 3416, 3417, 3418, 3419, 3420, 3421, 3422, 3423, 3424, 3425, 3426, 3427, 3428, 3433, 3434, 3437, 3438, 3445, 3446, 3449, 3450, 3451, 3456, 3457, 3458.

Species, *Cygnus olor*, Swan. Nos. 530, 531, 532, 674, 748, 816, 1468, 1469, 1536, 1537, 1912, 1987, 1988, 2467.

Species, *Cygnus atratus*, Black Swan. No. 2112.

Species, *Mergus Serrator*, Merganser. Nos. 281, 318, 1165.

## Class REPTILIA.

### Order CHELONIA.

Genus, *Testudo* — ? Tortoise. Nos. 249, 660, 661, 751, 752, 830, 1460, 1882, 1883, 1916, 1917, 2448, 3361, 3362, 3363.

Species, *Testudo Indica*, Indian Tortoise. Nos. 255A, 459, 510, 511, 512, 513, 659, 830, 920, 1194, 1461, 2450, 2451, 2452.

Species, *Testudo Græca*, Common Tortoise. Nos. 509, 671, 1277, 1278, 1607.

Species, *Testudo radiata*, Radiated Tortoise. Nos. 1192, 1193.

Species, *Testudo tabulata*, Tabulated Tortoise. No. 2449.

Species, *Chelydra serpentina*, Snake-tortoise. Nos. 778A, 1109A, 2722A, 2722B.

Species, *Emys Europæa*, Fresh-water Tortoise. Nos. 918, 2447, 2720.

Species, *Emys ornata*, Zebra Tortoise. No. 1271.

Species, *Chelonia Mydas*, Green Turtle. Nos. 6, 23, 131, 248, 460, 461, 461A, 514, 515, 516, 665, 666, 667, 668, 753, 813, 814, 831, 850, 851, 852, 853, 854, 864, 888, 919, 940, 956, 957, 958, 959, 960, 961, 962, 965, 966, 967, 968, 969, 970, 1110A, 1183, 1272, 1312, 1313, 1314, 1350, 1462, 1463, 1532, 1533, 1534, 1535, 1578, 1579, 1580, 1674, 1675, 1676, 1676A, 1766, 1767, 1768, 1821, 2105, 2130, 2444, 2445, 2446, 2718, 2719, 3351, 3352, 3353, 3354, 3355, 3356, 3357, 3358, 3359, 3360.

Species, *Chelonia imbricata*, Hawk's-bill, or Tiled Turtle. Nos. 662, 663, 664, 815, 855, 856, 1117, 1157, 2441, 2442.

Species, *Chelonia Caretta*, Keeled Turtle. No. 1110.

### Order SAURIA.

Species, *Crocodylus Lucius*, Alligator. Nos. 250, 517, 1189, 1348, 1349, 1467, 1606, 2104.

Species, *Crocodylus acutus*, Sharp-nosed Crocodile. Nos. 380, 388, 446, 518, 656, 657, 658, 670, 747, 829, 921, 921A, 922, 1118, 1119, 1120, 1121, 1122, 1123, 1182, 1315, 1316, 1317, 1318, 1464, 1465, 1466, 1577, 1887A, 2438, 2439, 2440, 3365, 3366, 3367.

Genus, *Crocodylus* — ? Crocodile. Nos. 2723, 2724, 2725, 3364, 3368, 3369, 3370, 3371, 3372, 3373, 3374.

Species, *Lacerta agilis*, Common Lizard. Nos. 445, 655, 2210, 2212, 2213, 2214, 2215, 2216, 2218, 2219, 2220, 2223, 2431, 3348, 3349, 3350.

Species, *Lacerta bilineata*, Two-streaked Lizard. Nos. 2211, 2712, 3341, 3342.

Species, *Lacerta quadrilineata*, Four-streaked Lizard. Nos. 3343, 3344.

Species, *Lacerta ocellata*, Ocellated Lizard. Nos. 2217, 2429, 2430.

- Species, *Tropidolepis undulatus*, Waved Lizard. No. 3345.  
 Species, *Podarcis muralis*, Wall Lizard. Nos. 2432, 3346, 3347.  
 Species, *Ameiva vulgaris*, Common Ameiva. Nos. 2221, 2222, 2713.  
 Species, *Ameiva lemniscata*, Banded Ameiva. No. 3337.  
 Genus, *Ameiva* — ? Ameiva. No. 3338.  
 Species, *Iguana tuberculata*, Common Guana. Nos. 671B, 746, 1107, 1108, 1109, 1576, 1820A, 1919, 1920, 2035, 2434, 2435, 2717.  
 Genus, *Iguana* — ? Guana. Nos. 387, 828, 1457, 1531, 3330.  
 Genus, *Anolis* — ? Anolis. Nos. 2436, 2714, 3334, 3335, 3336.  
 Species, *Ascalabotes verus*, Gecko. Nos. 2208, 2209.  
 Species, *Thecadactylus levis*, Sheath-clawed Gecko. Nos. 3332, 3333.  
 Species, *Agama atra*, Agama. Nos. 2433, 2716.  
 Genus, *Agama* — ? Agama. No. 386.  
 Species, *Draco viridis*, Dragon. No. 282A.  
 Species, *Chamæleo planiceps*, Senegal Chameleon. Nos. 282K, 1105, 1106, 1452, 1453, 1695, 1696, 1697, 2084B, 2437, 3327.  
 Species, *Chamæleo vulgaris*, Common Chameleon. Nos. 1454, 1455, 1698, 1699, 1764, 1765, 3328, 3329.  
 Genus, *Scincus* — ? Scink. Nos. 1918, 2427.  
 Species, *Tiliqua scincoides*, New Holland Scink. Nos. 1458, 1605, 2426.  
 Genus, *Tiliqua* — ? Scink. Nos. 2715, 3339, 3340, 3427.

#### Order OPHIDIA.

- Species, *Anguis fragilis*, Blind-worm. Nos. 1094, 2190B, 2422, 2423, 3325, 3326.  
 Species, *Ophisaurus ventralis*, Glass Snake. Nos. 2424, 2425.  
 Species, *Crotalus horridus*, Diamond Rattle-snake. Nos. 778, 802, 1091, 1819, 1921, 1922, 2106, 2162, 2419, 2709, 3314, 3315, 3316.  
 Species, *Vipera berus*, Black Adder. No. 2707.  
 Species, *Vipera communis*, Common Adder. Nos. 3309, 3310, 3311.  
 Species, *Naja tripudians*, Hooded or Spectacle Snake. Nos. 282E, 282F, 2164.  
 Species, *Natrix fusca*, Harmless Snake. Nos. 1088, 1922A, 2190, 2417, 2418, 3302, 3302A, 3303, 3304, 3305.  
 Species, *Elaphis quadrilineatus*, Four-lined Snake. No. 2420.  
 Species, *Periops Hippocratis*, Hippocrates' Snake. No. 2421.  
 Genus, *Coluber* — ? Snake. Nos. 2708, 2710, 3301, 3306, 3307, 3308, 3312, 3313, 3317, 3318, 3319, 3320, 3321, 3322, 3323, 3324.  
 Genus, *Coronella* — ? Snake. No. 444C.  
 Species, *Python Tigris*, Tiger Boa. Nos. 250A, 250B, 250C, 282D, 508A, 671A, 802A, 917B, 1093A.  
 Species, *Boa Constrictor*, Boa-constrictor. Nos. 2164A, 3308A.



Species, *Boa Scytale*. No. 812D.

Genus, *Pseudoboa* — ? Nos. 1092, 1093, 1820, 2163.

Species, *Pelamis bicolor*, Two-coloured Sea-snake. Nos. 508, 1089, 1090, 2711.

#### Order BATRACHIA.

Species, *Cecilia lumbricoides*, Lumbricoid Cecilia. No. 653.

Species, *Rana temporaria*, Common Frog. Nos. 444A, 669, 800, 887, 1098, 1099, 1180, 1815, 1816, 2409, 2410, 2411, 2412, 2413, 2414, 2703, 2704, 2856, 3270, 3271, 3272, 3273, 3279, 3279A, 3280, 3281, 3282, 3283, 3284, 3285.

Species, *Rana pipiens*, Bull-frog. Nos. 280, 1102, 1451, 1575, 2702, 3273A, 3291, 3292.

Species, *Rana paradoxa*, Fish-frog or Jackie. Nos. 745, 1067, 1068, 1069, 3286, 3286A, 3287, 3287A, 3287B, 3287C, 3287D, 3287E, 3287F, 3287G, 3287H, 3287I, 3287K, 3288, 3289, 3290.

Genus, *Rana* — ? Frog. Nos. 255K, 276A, 276B.

Species, *Bufo dorsiger*, Dorsigerous Toad. No. 3778.

Species, *Bufo fuscus*, Brown Toad. No. 2415.

Species, *Bufo vulgaris*, Common Toad. Nos. 444B, 1100, 1833, 1834, 2705, 2857.

Genus, *Bufo* — ? Toad. Nos. 3274, 3275, 3276.

Species, *Pipa monstrosa*, Surinam Toad. Nos. 276C, 801, 917A, 1103, 1104, 1817, 2416, 2706, 3277, 3278, 3293, 3294, 3295, 3779, 3780, 3781.

Species, *Salamandra maculosa*, Spotted Salamander. Nos. 799, 1814, 2407, 2408, 2701, 3296, 3297, 3298, 3299, 3300.

Species, *Salamandra atra*, Black Salamander. No. 3300A.

Species, *Triton palustris*, Eft. Nos. 798, 1065, 1066, 1095, 1096, 2190c, 2399, 2400, 2401, 2403, 2404, 3265, 3266.

Species, *Triton punctatus*, Punctate Eft. No. 2402.

Species, *Triton cristatus*, Crested Eft. Nos. 2405, 2406, 2698, 2699, 2700, 3267, 3268, 3268A, 3269.

Species, *Triton marmoratus*, Marbled Eft. No. 2697.

Species, *Amphiuma Means*, Common Amphiume. No. 915.

Species, *Amphiuma Didactylum*, Two-toed Amphiume. No. 2397.

Species, *Menopoma Alleghaniense*, Menopome. Nos. 654, 916, 917, 1450, 2398, 3264.

Species, *Sirena lacertina*, Siren. Nos. 246, 796, 797, 827, 912, 913, 913A, 914, 1062, 1063, 1064, 1179, 1399, 2108, 2695, 2696.

Species, *Sirena intermedia*, Intermediate Siren. No. 444.

#### Class PISCES.

#### Order PLACOIDES.

Species, *Selache maxima*, Basking Shark. Nos. 237A, 237B, 464A, 464B, 464C, 507C, 507D, 507E, 652B, 812A, 812B, 812C, 826A, 962A, 1058A, 1311A, 1347A, 1347B, 1670A, 1670B, 1670C, 1803A, 2059C, 2396A, 2396B.

- Species, *Galeus communis*, Tope or Gray Shark. Nos. 383A, 651, 652, 911, 1059, 1060, 1311, 1530, 1574, 1667, 1668, 1669, 1670, 1761, 1762, 1763, 2679.
- Species, *Carcharias Vulpes*, Fox-tailed Shark. Nos. 507B, 652A, 794A, 911C.
- Species, *Carcharias glaucus*, Blue Shark. Nos. 382, 383, 1061.
- Species, *Carcharias megalodon*, Great-toothed Shark. Nos. 118, 119.
- Genus, *Zygæna*.——? Hammer-headed Shark. No. 1760.
- Species, *Scoliodon Aristotelis*, Aristotle's Viviparous Shark. Nos. 2684, 2685, 2686.
- Species, *Spinax Acanthias*, Picked Dog-fish. Nos. 279A, 279B, 279C, 279D, 464, 507 507A, 647, 648, 649, 777, 795, 812, 826, 2036, 2036A, 2037, 2129, 2395, 2680, 2681, 2855, 3255, 3256, 3257, 3257A, 3257B, 3258, 3259.
- Species, *Pristis Antiquorum*, Saw-fish. No. 3263.
- Species, *Scyllium Canicula*, Spotted Dog-fish. Nos. 1178, 1395, 2396, 2687, 2688, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3253A, 3253B, 3254.
- Genus, *Squalus* ——? Shark. Nos. 3245, 3245A, 3260, 3261, 3262.
- Species, *Squatina Angelus*, Angel or Monk-fish. Nos. 650, 776, 2677, 2678, 3232, 3233.
- Genus, *Raia* ——? Skate. Nos. 505, 1671, 1672, 2691, 2692.
- Species, *Raia Batis*, Common Skate. Nos. 384, 645, 646, 909, 911A, 1310, 1347, 1528, 1569, 1570, 1571, 1572, 1573, 1671, 1672, 2394, 3236, 3237, 3238, 3239, 3240, 3240A, 3240B, 3241.
- Species, *Torpedo Narke*, Electric Ray. Nos. 506, 1046, 1047, 1048, 1049, 1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 3242, 3243, 3244.
- Species, *Raia maculata*, Homelyn. Nos. 2693, 2694, 3234, 3235.
- Species, *Trygon pastinaca*, Sting-ray. No. 1529.
- Species, *Cephaloptera manta*, Cephaloptera, or Horned-ray. Nos. 910, 1045, 1673, 2393.
- Species, *Callorhynchus antarcticus*, Southern Chimæra. Nos. 2676, 3235A, 3235B.

#### Order GANOIDES.

- Species, *Acipenser Sturio*, Sturgeon. Nos. 78, 231, 232, 233, 234, 235, 236, 463, 504, 636, 637, 638, 639, 640, 641, 642, 643, 644, 793, 794, 907, 908, 1042, 1043, 1044, 1185, 1309A, 1396, 1397, 1447, 1527, 1568, 1666, 1809.
- Species, *Syngnathus Ophidion*, Snake Pipe-fish. Nos. 2375, 3229.
- Species, *Syngnathus Typhle*, Deep-nosed Pipe-fish. Nos. 3223, 3226, 3227, 3785, 3786.
- Species, *Syngnathus Acus*, Great Pipe-fish. Nos. 2376, 2675, 3225.
- Species, *Syngnathus rubescens*, Red Pipe-fish. Nos. 1039, 1040.
- Species, *Syngnathus æquoreus*, Pipe-fish. Nos. 1041, 3224.
- Genus, *Syngnathus* ——? Pipe-fish. No. 3228.
- Species, *Hippocampus guttulatus*, Hippocamp. Nos. 2377, 3230, 3231, 3787.
- Species, *Diodon maculatus*, Diodon. No. 886.
- Species, *Tetraodon lagocephalus*, Tetradon. Nos. 2093, 2094.

Species, *Tetraodon ocellatus*, Ocellated Tetraodon. No. 503.

Species, *Tetraodon Pennantii*, Pennant's Tetraodon. No. 2095.

Species, *Orthogoriscus Mola*, Moon-fish. Nos. 905, 1648, 1649, 1655, 1656, 1657, 1665, 1665A.

#### Order CTENOIDES.

Species, *Serranus Cabrilla*, Smooth Serranus. No. 2671A.

Species, *Cottus Scorpius*, Short-spined Cottus. Nos. 632, 2673.

Species, *Rhombus maximus*, Turbot. Nos. 634, 811A.

#### Order CYCLOIDES.

Genus, *Labrus* —? Wrasse. No. 398.

Genus, *Julis* —? Rock-fish. No. 385.

Species, *Xiphias Gladius*, Sword-fish. Nos. 1647, 1661, 1662.

Species, *Scomber Scombrus*, Mackerel. Nos. 1033A, 1384, 1758, 2384, 2385, 2668, 2669, 2670, 2671, 3213, 3214, 3215.

Species, *Thynnus vulgaris*, Tunny. No. 1664.

Species, *Thynnus pelamys*, Bonito. Nos. 1651, 1663.

Species, *Mugil Capito*, Mullet. Nos. 502, 629, 1034, 1448.

Species, *Malapterurus electricus*, Electric Silure. No. 2189.

Species, *Esox Lucius*, Pike. Nos. 1567, 1803, 2381, 2672, 3216.

Species, *Belone vulgaris*, Gar-pike. No. 2055A.

Species, *Exocoetus volitans*, Flying-fish. Nos. 282, 628A.

Species, *Clupea Harengus*, Herring. No. 1759.

Species, *Clupea Pilchardus*, Pilchard. No. 1801.

Species, *Alosa communis*, Shad. No. 3212.

Species, *Salmo Fario*, Trout. Nos. 394, 395, 501A, 501B, 773A, 1659, 2386, 2387, 2388.

Species, *Salmo alpinus*, Char. No. 443B.

Species, *Salmo Salar*, Salmon. Nos. 635, 773, 1802, 2107, 2389, 2661, 2662, 3203, 3204.

Species, *Cyprinus Carpio*, Carp. Nos. 1885, 1886, 2092A, 3206.

Species, *Cyprinus Carassius*, Crucian Carp. No. 2664.

Species, *Cyprinus auratus*, Gold-fish. Nos. 2088, 2089, 2090, 2392, 3207, 3208.

Species, *Cyprinus Barbus*, Barbel. Nos. 2663, 3205.

Species, *Leuciscus vulgaris*, Dace. No. 3209.

Species, *Gadus Morrhua*, Cod. Nos. 36, 112, 113, 114, 115, 238, 239, 633, 774, 792, 1031, 1032, 1033, 1308, 1398, 1560, 1561, 1562, 1563, 1564, 1565, 1566, 1652, 1759A, 2390, 2391, 2665, 3210.

Species, *Merlangus Pollachius*, Whiting Pollach. No. 2666.



- Genus, *Gobius*, Goby. Nos. 2667, 3211.  
 Species, *Anarrhichas Lupus*, Wolf-fish. Nos. 501, 631, 811, 906, 1660, 1887, 2674, 3219.  
 Species, *Lophius piscatorius*, Angler. Nos. 381, 904, 3218, 3218A.  
 Species, *Cyclopterus Lumpus*, Lump-sucker. Nos. 744, 1177.  
 Species, *Lepadogaster Dentex*, Smooth-sucker. No. 1269.  
 Species, *Echineis Remora*, Sucking-fish. No. 2081.  
 Species, *Echineis Naucrates*, Large Sucking-fish. No. 2081A.

#### Order APODES.

- Species, *Muraena Zebra*, Zebra Eel. No. 630.  
 Species, *Conger vulgaris*, Conger Eel. Nos. 911B, 1035, 1036, 1037, 1038, 2092, 2660.  
 Species, *Anguilla latirostris*, Broad-nosed Eel. Nos. 393, 3202, 3202A.  
 Species, *Anguilla longirostris*, Long-nosed Eel. No. 1385.  
 Species, *Anguilla acutirostris*, Sharp-nosed Eel. No. 2660A.  
 Species, *Gymnotus electricus*, Electric Eel. Nos. 500, 628, 790, 791, 1449, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2379, 2380, 3220, 3221, 3222.

#### Order CYCLOSTOMI.

- Species, *Ammodytes Tobiatus*, Launce. No. 2378.  
 Species, *Ammodytes Lancea*, Sand Launce. No. 2675A.  
 Species, *Petromyzon fluviatilis*, Lampern. Nos. 230A, 230B, 396, 1027, 1028, 2374, 2658, 3196, 3197, 3198.  
 Species, *Petromyzon marinus*, Lamprey. Nos. 230C, 396A, 1022, 1023, 1024, 1025, 1026, 1029, 1030, 2373, 2659, 3199, 3200, 3201.  
 Species, *Myxine glutinosa*, Glutinous Hag. Nos. 230, 397.  
 Species, *Heptatremia cirratum*, Cirrated Hag. Nos. 1018, 1019, 1020, 1021.

### Sub-Kingdom MOLLUSCA.

#### Class CEPHALOPODA.

#### Order DIBRANCHIATA.

- Species, *Octopus vulgaris*, Poulp. Nos. 2080, 2657C.  
 Species, *Argonauta Argo*, Paper Nautilus, or Argonaut. Nos. 2962E, 2962F.  
 Species, *Argonauta rufa*, Red Argonaut. No. 2657B.  
 Species, *Argonauta hians*, Wide Argonaut. No. 2962G.  
 Species, *Loligo vulgaris*, Common Calamary. Nos. 77, 225, 308, 2041, 2125, 2657.  
 Species, *Loligo sagittata*, Sagittated Calamary. Nos. 443A, 498, 499, 2657D.

- Species, *Onychoteuthis gigas*, Great Hooked Calamary. No. 63.  
 Species, *Onychoteuthis Banksii*, Banks's Hooked Calamary. Nos. 902A, 903.  
 Species, *Sepioteuthis loliginiformis*, Broad Calamary. No. 885.  
 Species, *Sepioteuthis Australis*, Australian Calamary. No. 2657A.  
 Species, *Rossia palpebrosa*, Ross's Calamary. No. 2962A.  
 Species, *Sepia officinalis*, Cuttle-fish. Nos. 81, 104, 105, 106, 107, 108, 109, 222, 226, 305, 306, 307, 495, 496, 497, 627, 770, 775, 789, 885, 901, 902, 1016, 1017, 1306B, 1307, 1394, 1559B, 1629, 1630, 1631, 1632, 1633, 1634, 1635, 1636, 1637, 1638, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 2040, 2042, 2126, 2127, 2371, 2372, 2652, 2653, 2654, 2654A, 2655, 2656, 2953, 2954, 2955, 2956, 2957, 2958, 2959, 2960, 2961, 2962.  
 Species, *Sepiolo Rondeletii*, Sepiole. No. 2372A.

#### Order TETRABRANCHIATA.

- Species, *Nautilus Pompilius*, Pearly Nautilus. Nos. 499A, 626A, 788A, 900B, 1306A, 2651A.

#### Class GASTROPODA.

- Species, *Pterocera Scorpio*. No. 2368.  
 Species, *Purpura patula*. Nos. 102, 1014, 1445, 2124A, 2949C.  
 Genus, *Ranella* — ? Rock-shell. No. 2950A.  
 Genus, *Turbinella* — ? No. 2950.  
 Species, *Neritina fasciata*. No. 97A.  
 Species, *Triton rudis*. No. 1887B.  
 Species, *Buccinum undatum*, Whelk. Nos. 1015, 1441, 1442, 1443, 1444, 2651, 2948, 2949, 2949A, 3787B.  
 Genus, *Buccinum* — ? No. 2944.  
 Species, *Pyrula Rapa*. No. 2947A.  
 Genus, *Voluta* — ? Volute. No. 1141.  
 Species, *Cypræa Tigris*, Tiger Cowry. Nos. 82, 93A.  
 Genus, *Cypræa*, Cowry. No. 2949B.  
 Species, *Oliva porphyria*, Camp Olive. No. 14.  
 Species, *Turbo pica*. Nos. 99, 100, 101, 1446.  
 Species, *Calyptræa adolpheii*. No. 1013A.  
 Species, *Calyptræa radiata*. No. 1013A.  
 Species, *Paludina vivipara*. Nos. 2942, 2943.  
 Species, *Janthina fragilis*. Nos. 2945, 2946.  
 Species, *Carinaria mediterranea*. No. 2370A.  
 Species, *Bulla lignaria*. No. 492.  
 Species, *Bullæa aperta*. Nos. 403, 404, 493, 494.  
 Genus, *Haliotis* — ? Ear-shell. No. 98.  
 Species, *Haliotis Iris*. No. 98A.  
 Species, *Haliotis tuberculata*. Nos. 98B, 489, 1009.

- Species, *Fissurella* — ? No. 1008.  
 Species, *Patella vulgata*, Limpet. No. 488.  
 Species, *Patella deaurata*. Nos. 221, 1007.  
 Species, *Chiton squamosus*, Chiton. Nos. 624, 1006.  
 Species, *Limax ater*, Black Slug. Nos. 303, 491, 769, 787, 788, 883, 1087, 1389, 1390, 2297, 1306.  
 Species, *Limax rufus*, Red Slug. Nos. 1304, 1305, 2298, 2299, 2300, 2302.  
 Species, *Limax albus*, White Slug. No. 2301.  
 Species, *Helix Pomatia*, Great Shell-snail. Nos. 301, 302, 767, 768, 786, 882, 1081, 1082, 1083, 1084, 1085, 1086, 1176, 1391, 1392, 1393, 1756, 2124, 2303, 2304, 2939, 2940, 2941.  
 Species, *Helix hortensis*, Garden Snail. Nos. 96, 2934, 2935.  
 Species, *Helix aspersa*, Hedge Snail. Nos. 2305, 2306, 2307, 2308, 2309, 2311, 2315, 2846, 2847, 2848, 2849.  
 Species, *Helix nemoralis*, Wood Snail. No. 2310.  
 Genus, *Helix* — ? Snail. Nos. 2936, 2937, 2938.  
 Species, *Bulinus hæmastomus*. No. 900A.  
 Species, *Bulinus meleagris*. No. 2943B.  
 Genus, *Bulinus* — ? No. 2943A.  
 Species, *Limnæa auricularia*. No. 97.  
 Species, *Limnæa stagnalis*. No. 2313.  
 Species, *Scyllæa pelagica*. No. 490.  
 Species, *Aplysia Camelus*. No. 1013.  
 Species, *Aplysia alba*. Nos. 625, 626, 1011, 1012.  
 Species, *Doris tuberculata*. No. 1010.  
 Species, *Tritonia Hombergii*. No. 304.

#### Class PTEROPODA.

- Species, *Clio borealis*. No. 323A.

#### Class LAMELLIBRANCHIATA.

- Species, *Clavagella lata*, Broad Clavagella. No. 487A.  
 Species, *Pholas crispata*. No. 1142.  
 Species, *Solen siliqua*, Razor-shell. Nos. 617, 1005.  
 Species, *Mya truncata*. No. 2949A.  
 Species, *Cardium edule*, Common Cockle. No. 52.  
 Species, *Cardium echinatum*, Spiny Cockle. Nos. 618, 619.  
 Species, *Tridacna gigas*, Great Clam. Nos. 620, 621, 2077.  
 Species, *Anodon cygneus*, Frsh-water Mussel. Nos. 53, 66, 67, 94A, 622, 884, 900, 1002, 1003, 1004.



- Species, *Mytilus edulis*, Mussel. No. 94.  
 Species, *Pinna fragilis*. No. 2076.  
 Species, *Meleagrina margaritifera*, Pearl Oyster. No. 1001.  
 Species, *Pecten maximus*, Great Scallop. Nos. 623, 899, 999, 1000, 1388.  
 Species, *Ostrea edulis*, Oyster. Nos. 50, 51, 65, 95, 404A, 881, 2932, 2932A.

### Class BRACHIOPODA.

- Species, *Lingula Audebardii*. No. 998c.  
 Species, *Orbicula lamellosa*. Nos. 479A, 998A, 998B.  
 Species, *Terebratula Chilensis*. No. 998A.  
 Species, *Terebratula dorsata*. No. 2242B.  
 Species, *Terebratula psittacea*. No. 2242c.

### Class TUNICATA.

- Genus, *Salpa* — ? Nos. 76, 484, 2166B.  
 Species, *Salpa gibbosa*. Nos. 480, 481.  
 Species, *Salpa infundibuliformis*. Nos. 482, 483.  
 Species, *Salpa cristata*. No. 485.  
 Species, *Salpa polycratica*. No. 486.  
 Species, *Pyrosoma atlanticum*. No. 2166A.  
 Species, *Ascidia intestinalis*. No. 616.  
 Species, *Cynthia tuberculata*. Nos. 614A, 898B, 1303C, 2242A.  
 Species, *Cynthia papillosa*. No. 998.  
 Species, *Phallusia nigra*. No. 615.  
 Species, *Boltenia reniformis*. Nos. 614, 785.

### Sub-Kingdom ARTICULATA.

#### Class CIRRIPEDIA.

- Species, *Pentelasmus vitrea*, Brittle Barnacle. Nos. 478, 479, 994, 2286, 2287, 2288, 2930.  
 Species, *Pentelasmus anatifera*, Goose Barnacle. Nos. 2285, 2929.  
 Species, *Otion Cuvieri*, Eared Barnacle. Nos. 62, 68, 69, 613, 997.  
 Species, *Balanus sulcatus*, Furrowed Balanite. No. 54.  
 Species, *Balanus rugosus*, Rough Balanite. No. 996.  
 Species, *Balanus Tintinnabulum*, Bell Balanite. No. 2289.  
 Species, *Tubicinella Balanarum*, Tube Balanite. No. 995.

## Class CRUSTACEA.

## Order ISOPODA.

Species, *Æga emarginata*. No. 2649.

Species, *Cymothoë Lichtenaultii*. No. 3183.

## Order MACROURA.

Species, *Astacus marinus*, Lobster. Nos. 22, 60, 110, 223, 407, 408, 880, 898A, 991, 992, 1301, 1302, 1302A, 1303, 2204A, 2205, 2206, 2207, 2207A, 2367, 3188, 3189.

Species, *Astacus fluviatilis*, Craw-fish. Nos. 406, 993, 993A, 2191, 2192, 3185, 3186, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2366, 2650, 3187, 3782, 3783.

Species, *Palæmon serratus*, Prawn. No. 993B.

Genus, *Crangon* — ? Shrimp. No. 3184.

Species, *Galatea striata*. No. 2046.

Species, *Scyllarus antarcticus*. No. 1303A.

Species, *Pagurus Miles*, Soldier Crab. No. 1559A.

Species, *Pagurus punctulatus*, Hermit Crab. Nos. 612A, 993D, 1303B.

Species, *Pagurus streblonyx*, Common Hermit Crab. No. 3190.

Species, *Birgus Latro*, Robber Crab. Nos. 612B, 993C.

## Order BRACHYURA.

Species, *Cancer Pagurus*, Common Crab. No. 993E.

Genus, *Cancer* — ? Crab. Nos. 3191, 3784.

Species, *Carcinus Menas*, Crab. No. 993F.

Genus, *Xantho* — ? Crab. Nos. 3193, 3784A, 3784B.

Genus, *Grapsus* — ? Crab. No. 3194.

Species, *Maia Squinado*, King Crab. No. 3192.

## Class ARACHNIDA.

## Order PULMONARIA.

Genus, *Aranea* — ? Spider. Nos. 3174, 3175, 3176, 3177, 3178, 3179, 3180.

Species, *Mygale avicularia*, Bird Spider. Nos. 1625A, 3180A.

Species, *Mygale cancerides*. No. 2364.

Species, *Mygale fasciata*. No. 2648A.

Species, *Buthus Africanus*, Great Scorpion. Nos. 612, 1625, 2043, 2161, 2365, 2647, 2648, 3181, 3182.

## Class INSECTA.

## Order COLEOPTERA.

- Species, *Lampyrus splendidula*, Glow-worm. No. 2362.  
 Species, *Melolontha vulgaris*, Cockchaffer. Nos. 606, 1079A, 2353, 2641, 2642, 2853.  
 Species, *Melolontha solstitialis*, Summer-chaffer. Nos. 2352, 2643, 2854, 3066, 3067.  
 Species, *Geotrupes stercorarius*, Dung-beetle. Nos. 2355, 2644, 2645, 3078, 3079.  
 Genus, *Scarabæus* — ? Beetle. Nos. 2356, 3077.  
 Species, *Scarabæus vernalis*, Spring Beetle. Nos. 3068, 3069.  
 Species, *Cetonia aurata*, Rose Beetle. Nos. 2357, 2358, 2359, 3070, 3071.  
 Species, *Cetonia Chinensis*. No. 2646B, 3071A.  
 Species, *Lucanus Cervus*, Stag-beetle. Nos. 1077, 2646.  
 Species, *Buprestis superba*. No. 2646A.  
 Species, *Dynastes Hercules*, Hercules Beetle. No. 225.  
 Species, *Dynastes Gideon*, Gideon Beetle. Nos. 2361A, 2361B, 2646C.  
 Species, *Megasoma Titanus*, Titan Beetle. No. 2360.  
 Species, *Cerambyx moschatus*, Musk Beetle. No. 2363.  
 Genus, *Cerambyx* — ? Capricorn Beetle. Nos. 472, 3065, 3072, 3073.  
 Species, *Prionus cervicornis*, Great Stag-beetle. Nos. 3074, 3075, 3076.  
 Species, *Calandra Palmarum*, Palm-beetle. Nos. 3080, 3081, 3082, 3083.  
 Species, *Blaps mortisaga*, Darkling Beetle. No. 2354.

## Order ORTHOPTERA.

- Species, *Locusta serrata*, Serrated Locust. No. 443.  
 Genus, *Locusta* — ? Locust. Nos. 405, 475, 2044.  
 Species, *Acrida viridissima*, Green Locust. Nos. 300, 473, 474, 784, 2350, 2351, 3166.  
 Genus, *Acrida* — ? Grasshopper. Nos. 610, 3167, 3168.  
 Species, *Pterophylla myrtifolia*, Myrtle Locust. No. 3165.  
 Species, *Mantis religiosa*, Praying Mantis. No. 3169.  
 Genus, *Mantis* — ? Praying Insect. Nos. 3170, 3171.  
 Species, *Phasma Gigas*, Spectre Insect. No. 3172.  
 Species, *Blatta Orientalis*, Cockroach. Nos. 607, 608, 609, 3163, 3163A, 3164.  
 Species, *Blatta Americana*, Cakerlac. No. 3162.  
 Species, *Gryllotalpa vulgaris*, Mole-cricket. Nos. 611, 784A, 1076.

## Order HEMIPTERA.

- Genus, *Reduvius* — ? Harvest-bug. No. 2606.  
 Genus, *Pentatoma* — ? Land-bug. Nos. 2607, 3159A.



Genus, *Scutellera* — ? No. 2608.

Species, *Belostoma grandis*, Great Water-bug. Nos. 3160, 3161.

Genus, *Cicada* — ? Tree-hopper. Nos. 296, 597, 2330, 2330A.

Species, *Cicada Australasiæ*, Australian Cicada. Nos. 2329, 3156, 3157, 3158, 3159.

Species, *Aphis Abietis*, Fir Aphis. Nos. 2972, 2972A.

Species, *Aphis Bursariæ*, Poplar Aphis. No. 2973.

#### Order NEUROPTERA.

Species, *Æstha grandis*, Dragon-fly. Nos. 1626, 1627.

Species, *Termes bellicosus*, Fighting Termite. Nos. 598, 599, 600, 3145A, 3146, 3146A, 3147, 3148, 3149, 3150, 3150A, 3150B.

Species, *Termes mordax*, Biting Termite. Nos. 3150C, 3151, 3151A, 3151B.

Species, *Termes Arborum*, Tree Termite. Nos. 3151C, 3151D, 3151E.

Species, *Phryganea grandis*, Caddis-fly. No. 3153.

Genus, *Phryganea* — ? Caddis-fly. No. 3154.

#### Order HYMENOPTERA.

Species, *Apis mellifica*, Hive-bee. Nos. 477, 604, 605, 2154, 2155, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2609, 2610, 2611, 2612, 2613, 2614, 3124, 3125, 3126, 3127, 3128, 3129, 3130, 3131, 3132, 3133, 3134, 3135, 3136, 3137, 3138, 3139, 3140, 3141, 3142.

Genus, *Ichneumon* — ? Ichneumon. No. 3090.

Genus, *Microgaster* — ? Ichneumon. Nos. 3084, 3085, 3086, 3087, 3088, 3089.

Species, *Cynips Rosæ*, Rose Gall-insect. No. 2975.

Genus, *Tenthredo* — ? Saw-fly. No. 3091.

Genus, *Formica* — ? Ant. Nos. 3143, 3144, 3145.

Species, *Bombus terrestris*, Humble-bee. Nos. 476, 601, 602, 603, 898, 1078, 1079, 1439, 1440, 2157, 2158, 2159, 2342, 2343, 2344, 2615, 2616, 2617, 2618, 2619, 2852, 3117, 3118, 3119, 3120, 3121, 3122, 3123.

Species, *Bombus lapidaria*. Nos. 297, 298, 299.

Species, *Xylocopa violacea*, Carpenter-bee. No. 2620.

Species, *Xylocopa latipes*. No. 2621.

Species, *Xylocopa Brazilianorum*. No. 2622.

Genus, *Xylocopa* — ? Carpenter-bee. No. 2623.

Species, *Osmia bicornis*, Horned Bee. No. 2624.

Species, *Megachile centuncularis*, Leaf-cutter, or Carpenter-bee. Nos. 2625, 3110, 3111, 3112, 3113, 3114, 3115, 3116.

Species, *Vespa vulgaris*, Wasp. Nos. 2156, 2345, 2346, 2347, 2348, 2626, 2627, 2628, 2629, 3102, 3103, 3108, 3109.

- Species, *Vespa Crabro*, Hornet. Nos. 2349, 2632, 2633, 2634, 2635, 2636, 2637, 3093, 3094, 3095, 3096, 3097, 3098, 3099, 3100, 3101.  
 Genus, *Sphex*, Sphex. Nos. 2639, 2640.  
 Genus, *Bembex* — ? No. 3092.  
 Species, *Vespa cincta*. No. 2638.  
 Species, *Odynerus parietinus*, Mason-wasp. No. 3107.  
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- Genus, *Papilio* — ? Butterfly. Nos. 3056, 3057, 3057A, 3058.  
 Species, *Papilio Piera*. No. 3053.  
 Species, *Pieris Brassicæ*, Cabbage Butterfly. No. 3055.  
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 Species, *Cerula vinula*, Puss-moth. Nos. 897, 3038.  
 Species, *Lasiocampa Neustria*, Lackey-moth. No. 3045.  
 Species, *Lasiocampa Quercus*, Egger-moth. No. 3046.  
 Species, *Eriogaster lanestris*, Small Egger-moth. No. 3059.  
 Genus, *Bombyx* — ? Moth. Nos. 3045, 3047, 3050.  
 Species, *Cossus ligniperda*, Goat-moth. No. 3048.  
 Species, *Zeuzera Æsculi*, Wood Leopard-moth. No. 3051.  
 Species, *Laria pudibunda*, Tussock-moth. No. 3052.  
 Species, *Sphinx Ligustri*, Privet Hawk-moth. Nos. 2851, 3041.  
 Species, *Smerinthus Populi*, Poplar Hawk-moth. No. 3040.  
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*Lepidopterous Larvæ or Nidi*. Nos. 1299, 2975A, 3049.

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- Species, *Helophilus pendulus*, Rat-tail Fly. No. 596.  
 Genus, *Culex* — ? Gnat. Nos. 2967, 2968, 2969, 2969A.

Species, *Æstrus Tarandi*, Breeze-fly. Nos. 2970, 2971.

Species, *Musca carnaria*, Flesh-fly. Nos. 2123, 2963, 2964, 2965, 2966.

Species, *Musca domestica*, House-fly. No. 2325.

#### Order APTERA.

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Species, *Scolopendra morsitans*, Great Centipede. Nos. 1298, 2160.

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#### Order TUBICOLA.

Species, *Sabella pavonina*. Nos. 441, 990.

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Species, *Aphrodita aculeata*, Sea-mouse, or Spiny Aphrodite. Nos. 442A, 465, 595, 782, 783, 849, 875A, 984A, 985, 986, 987, 988, 1297, 2068.

Species, *Amphinome capillata*, Golden Aphrodite. Nos. 875, 989.

Species, *Polynoe squamata*, Scaly Aphrodite. No. 401.

Species, *Lycoris foliosa*, Leafy Nereis. Nos. 58, 402.

Species, *Pleione æolides*. No. 440.

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Species, *Lumbricus terrestris*, Earth-worm. Nos. 470, 595B, 876, 877, 878, 1296, 2067, 2294, 2295, 2296, 2931.

Species, *Hirudo (Sanguisuga) medicinalis*, Medicinal Leech. Nos. 57, 295A, 442, 466, 467, 468, 469, 595A, 873, 874, 1295, 2078, 2290, 2291, 2292, 2293.

Species, *Pontobdella muricata*, Sea-leech, or Skate-sucker. No. 1295A.



## Sub-Kingdom ZOOPHYTA.

## Class ENTOZOA.

## Sub-Class CÆLELMINTHA.

## Order NEMATOIDEA.

Species, *Filaria Rheæ*. Nos. 2324A, 2600B.

Genus, *Filaria* —? No. 2600A.

Species, *Gnathostoma spinigerum*. Nos. 2324B, 2600C.

Species, *Strongylus inflexus*. No. 2600D.

Species, *Strongylus Gigas*. Nos. 1294B, 2600E.

Species, *Linguatula tænioides*. No. 1294C.

Species, *Ascaris lumbricoides*, Round-worm. Nos. 439, 1294, 1294A, 2324, 2596, 2597, 2598, 2599, 2600.

Species, *Ascaris Halicoris*. No. 439A.

## Order ACANTHOCEPHALA.

Species, *Echinorhynchus porrigens*. Nos. 289, 290, 291, 292, 293, 294, 413, 414.

Species, *Echinorhynchus glandiceps*. Nos. 295, 415, 2323.

## Sub-Class STERELMINTHA.

## Order TREMATODA.

Species, *Distoma ventricosum*. No. 416.

Species, *Distoma hepaticum*, Liver-fluke. No. 846.

Species, *Distoma clavatum*. No. 2079.

## Order CESTOIDEA.

Species, *Bothriocephalus Pythonis*. Nos. 846A, 2079A.

Species, *Tænia Solium*, Tape-worm. Nos. 843, 844, 845, 2282, 2283, 2284.

Species, *Tænia plicata*. No. 2079B.

## Order CYSTICA.

Species, *Cysticercus tenuicollis*, Long-necked Hydatid. Nos. 409, 409A, 410.

Species, *Cænurus cerebrealis*, Brain Hydatid. Nos. 411, 412, 2228.

## Class ECHINODERMA.

## Order APODA.

Species, *Sipunculus phalloides*. Nos. 438A, 1292, 1293, 1893, 2066, 2242.

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- Species, *Holothuria vittata*. Nos. 437, 438, 2241.  
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- Species, *Cyanea aurita*, Medusa. No. 2235.  
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- Species, *Zoanthus Ellisii*, Ellis's Animal-flower. Nos. 422, 423.  
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 Species, *Actinia crassicornis*, Sea-anemony. Nos. 426, 427, 1386.  
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Species, *Caryophyllia Cyathus*. No. 82B.

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## Order NATANTES.

Species, *Pennatula phosphorea*, Luminous Sea-pen. Nos. 88, 2166, 2945.

Species, *Pennatula grisea*. Nos. 227, 228, 229, 418.

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Species, *Lobularia digitata*. Nos. 91, 92, 417, 2232.

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THE END.

*Wm. Clift.*

Printed by Richard and John E. Taylor, Red Lion Court, Fleet Street.



